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APPEAL BRIEF TRANSMITTAL		Docket Number: **10744/4200**	Conf. No. **1578**
Application Number **09/824,193**	Filing Date **April 2, 2001**	Examiner **Mark O. Budd**	Art Unit ~~2632~~ 2834
Invention Title **COMPENSATION OF BATCH VARIATION IN THE TRAVEL DUE TO VARIATIONS IN THE LAYER THICKNESS OR NUMBER OF LAYERS IN MULTI-LAYER PIEZOELECTRIC ELEMENTS**		Inventor **RUEGER et al.**	

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Date: October 10, 2003

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Further to the Notice of Appeal dated April 10, 2003, for the above-referenced application, enclosed are three copies of an Appeal Brief. Accompanying the Appeal Brief is the Appendix to the Appeal Brief.

The Commissioner is hereby authorized to charge payment of the 37 C.F.R. § 1.17(c) appeal brief filing fee of $330.00, a four-month extension fee of $1,480 under § 1.17(a)(3), and any additional fees associated with this communication to the deposit account of **Kenyon & Kenyon**, deposit account number **11-0600**.

Dated: October 10, 2003

By: [signature]
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[10744/4200]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Johannes-Joerg RUEGER et al.	Examiner: Mark O. Budd
For: COMPENSATION OF BATCH VARIATION IN THE TRAVEL DUE TO VARIATIONS IN THE LAYER THICKNESS OR NUMBER OF LAYERS IN MULTI-LAYER PIEZOELECTRIC ELEMENTS	
Filed: April 2, 2001	Art Unit ~~2632~~ 2834
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Date: October 10, 2003

Signature: Richard L. Mayer (Reg. No. 22,490)

B. Reg. 42,194

APPEAL BRIEF PURSUANT TO 37 C.F.R. § 1.192(a)

S I R:

In the above-identified patent application ("the present application"), Appellants mailed a Notice of Appeal on April 10, 2003 from the Final Office Action issued by the United States Patent and Trademark Office on October 10, 2002. In the Final Office Action, claims 1 to 34 were finally rejected. An Advisory Action was mailed on June 18, 2003.

In accordance with 37 C.F.R. § 1.192(a), this Appeal Brief is submitted in triplicate in support of the appeal of the final rejections of claims 1 to 34. For the reasons more fully set forth below, the final rejections of claims 1 to 34 should be reversed.

1. REAL PARTY IN INTEREST

The real party in interest in the present appeal is Robert Bosch GmbH of Stuttgart in the Federal Republic of Germany. Robert Bosch GmbH is the assignee of the entire right, title and interest in the present application.

2. RELATED APPEALS AND INTERFERENCES

There are no interferences or other appeals "which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal."

3. STATUS OF CLAIMS

Claims 8 to 17 stand finally rejected under 35 U.S.C. § 112 as indefinite.

Claims 1, 3, 4, 18, 20, 21, and 25 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by Japanese Published Patent Application No. 7-107753 ("Hirotada et al.") or Japanese Published Patent Application No. 63-167684 ("Katsuhiro et al.").

Claims 1, 2, 8, 9, 18, 19, 25 and 26 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by U. S. Patent No. 4,593,658 ("Moloney").

Claims 3 to 7, 10 to 14, 20 to 24, and 30 to 31 stand finally rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and U. S. Patent No. 5,384,507 ("Takada et al.") or U. S. Patent No. 6,340,858 ("Jaenker").

Claims 15 to 17 and 32 to 34 stand finally rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and Takada et al. or Jaenker and U.S. Patent No. 5,575,264 ("Barron") or U.S. Patent No. 6,247,451 ("Estevenon et al.").

A copy of the appealed claims is attached hereto in the Appendix.

4. STATUS OF AMENDMENTS

In response to the Final Office Action mailed on October 15, 2002, a Reply Under 37 C.F.R. § 1.116 was filed on February 21, 2003. No proposed amendments to the claims were presented in the Reply Under 37 C.F.R. § 1.116.

5. SUMMARY OF THE INVENTION

The present invention relates to an apparatus and a method for charging a piezoelectric element while compensating for deviations in the due to, for example, manufacturing variations in the piezoelectric elements. Specification, page 1, lines 9 to 11.

As noted in the Specification, in fuel injection systems, a goal is to achieve a desired fuel injection volume with high accuracy, especially at small injection volumes, for example, during pilot injection. Specification, page 3, lines 23 to 25. In the example of a double acting control valve, it has proven to be difficult to determine and apply an activation voltage suitable for all injection elements and the whole lifetime of the injection system with sufficient precision such that, for example, a corresponding valve plug is accurately positioned for maximum fuel flow. Specification, page 3, lines 25 to 31.

It was previously assumed that the relationship between the piezoelectric travel and its voltage could be established with good accuracy and reproducibility by means of a characteristic curve that was determined for all actuators of the same structural design. Specification, page 3, line 33 to page 4, line 3. However, aging symptoms may have a very disruptive effect in operation of the entire injector or the pump element. Specification, page 4, lines 7 to 8.

Moreover, variations in the layer thickness or the number of layers affect the maximum piezoelectric travel for voltage control or charge control. Specification, page 4, lines 10 to 12. By measuring changes of the piezoelectric capacitance over the charging or discharging time with a specified current the disruptive effect due to the aging of

the actuator may be cured. Specification, page 4, lines 12 to 15. Manufacturing tolerances that exist from the outset, however, cannot be eliminated in this way. Specification, page 4, lines 16 to 17.

Therefore the present invention provides for an apparatus and a method for compensating, on an approximate basis, for manufacturing variations in piezoelectric elements, thereby ensuring proper operation of the injectors or pump element containing piezoelectric elements. Specification, page 4, lines 19 to 24.

According to one example embodiment of the present invention, an activation voltage value for charging the piezoelectric element is controlled online by a compensation unit which adjusts the activation voltage and activation charge in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. Specification, page 4, line 31 to page 5, line 3.

According to another example embodiment of the present invention, a definition may be made, prior to charging, as to a value for an activation voltage and an activation charge of the piezoelectric element, as a function of batch variation in the travel of the piezoelectric element. Specification, page 5, lines 5 to 9.

As such, the present invention provides compensation for batch variation in the piezoelectric element's travel due to variations in the layer thickness, or the number of layers (in the case of multi-layer piezoelectric elements) to thereby achieve a higher degree of accuracy in the piezoelectric element's travel. Specification, page 5, lines 11 to 15.

Manufacturing tolerances, such as those that are inevitable in the fabrication of piezoelectric actuators, may be compensated for to ensure a more accurate functioning of the actuator. Specification, page 5, lines 17 to 20.

Thus, an alternative is provided for compensating for the piezoelectric travel without having to measure the

capacitance of the component. Specification, page 5, lines 22 to 25.

In compensating for the above-identified variation in the travel the following equation (1) may be used:

$$h_{actual} = n_{actual} \cdot d_{33} \cdot U_{norm} \qquad (1)$$

Specification, page 27, lines 27 to 30.

In equation (1), n_{actual} is the number of layers of the multi-layer piezoelectric element; d_{33} is the piezoelectric coefficient; U_{norm} is the applied voltage before any correction; and h_{actual} is the lifting distance traveled by the piezoelectric element (which may be measured directly after the manufacturing of the piezoelectric element as one part of the manufacturing process). Specification, page 27, line 32 to page 28, line 3. While it is possible to obtain a full range of data for the lifting (h_{actual}) as a function of voltage, it would require taking repetitive measurements which may be unnecessary. Specification, page 28, lines 4 to 6. Accordingly, for this measurement only the lifting for the maximum voltage U_{max} can be measured. Specification, page 28, lines 6 to 8. That is, for this measurement only U_{norm} would be equal to U_{max}. Specification, page 28, lines 8 to 9. For all other applications U_{norm} is considered to be the voltage which is applied to an ideal piezoelectric element as a target voltage for a certain lift without taking into account any correction values. Specification, page 28, lines 9 to 12.

Equation (1) yields the voltage correction factor K for the voltage as follows:

$$K = h_{norm} / h_{actual} \qquad (2)$$

Specification, page 28, lines 14 to 17. In equation (2) h_{norm} represents the piezoelectric element's standard travel at a given voltage. Specification, page 28, lines 19 to 20. This value represents the expected travel of the piezoelectric element at a given voltage. Specification, page 28, lines 20 to 21.

Therefore, the following holds for voltage U which compensates for the fluctuations in the number of layers or differences in the piezoelectric coefficient d_{33}:

$$U = f_1(K) \;.\; U_{norm} \qquad (3)$$

Specification, page 28, lines 23 to 27.

Similarly, in compensating for fluctuations in the layer thickness a corrected charge value (Q) is determined in the following manner.

$$h_{actual} = d_{actual} . (1/A) . (d_{33}/\varepsilon_{33} . \varepsilon_0) . Q_{norm} \qquad (4)$$

Specification, page 28, lines 29 to 33. Equation (4) holds for the measured start value of the travel where, d_{actual} is the existing averaged-layer thickness; Q_{norm} is the sum of the charges that would be brought on an ideal piezoelectric element for a certain action in the absence of interference from manufacturing or any other anomaly; A is the effective area of the multi-layer actuator and ε_{33} is the dielectric coefficient; and ε_0 is the dielectric coefficient of an ideal piezoelectric element. Specification, page 29, lines 1 to 8. Thus, h_{actual} is a linear function of Q also. Specification, page 29, line 10.

Equation (4) yields charge correction factor $K_Q = K$ in a similar fashion as equation (2):

$$K = h_{norm} \;/\; h_{actual} \qquad (5)$$

Specification, page 29, lines 12 to 15.

The following holds for charge Q which compensates for the fluctuation in the layer thickness:

$$Q = f_2(K) \;.\; Q_{norm} \qquad (6)$$

Specification, page 29, lines 17 to 20.

Therefore, in an embodiment of the present invention, the same correction factor can be used, whether the actuator is going to be charged with a certain voltage or a certain charge. Specification, page 29, lines 22 to 24.

The measured correction factor may be measured for each individual actuator and stored in the control unit. For example, this may be realized within an EEPROM in the control unit. As embodied herein, the respective correction factors may be read from the EEPROM for test purposes. Specification, page 29, lines 26 to 30.

In an example embodiment of the present invention, an apparatus for charging a piezoelectric element is characterized in that an activation voltage and an activation charge value for driving the piezoelectric element is controlled online by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. Claim 1.

In an example embodiment of the present invention, a method for charging a piezoelectric element is characterized in that a definition is made, prior to charging, as to a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of batch variation in the travel of the piezoelectric element. Claim 8.

In an example embodiment of the present invention, an apparatus for charging a piezoelectric element includes a control unit configured to control an activation voltage and an activation charge value to drive the piezoelectric element, the control unit configured to adjust the activation voltage and activation charge value to compensate for a deviation caused by a variation of at least one of a layer thickness of the piezoelectric element and a number of layers of the piezoelectric element. Claim 18.

In an example embodiment of the present invention, a method for charging a piezoelectric element includes the step of defining, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element. Claim 25.

6. **ISSUES**

A. Whether claims 8 to 17 are definite under 35 U.S.C. § 112, second paragraph.

B. Whether claims 1, 3, 4, 18, 20, 21, and 25 are patentable under 35 U.S.C. § 102(b) over Hirotada et al. or Katsuhiro et al.

C. Whether claims 1, 2, 8, 9, 18, 19, 25 and 26 are patentable under 35 U.S.C. § 102(b) over Moloney.

D. Whether claims 3 to 7, 10 to 14, 20 to 24, and 30 to 31 are patentable under 35 U.S.C. § 103(a) over the combination of Moloney and Takada et al. or Jaenker.

E. Whether claims 15 to 17 and 32 to 34 are patentable under 35 U.S.C. § 103(a) over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al.

7. **GROUPING OF CLAIMS**

ISSUE A:

Group I: Claims 8 to 17 stand or fall together.

ISSUE B:

Group I: Claims 1 and 18

Group II: Claims 3, 4, 20, and 21

Group III: Claim 25

With respect to Issue B, claims within each Group stand or fall together with the other claims of that Group. However, each Group of claims does not stand or fall together with any other Group of claims.

ISSUE C:

Group I: Claims 1, 2, 18, and 19

Group II: Claims 8, 9, and 25

Group III: Claim 24

With respect to Issue C, claims within each Group stand or fall together with the other claims of that Group.

However, each Group of claims does not stand or fall together with any other Group of claims.

ISSUE D:

Group I: Claims 3, 10, and 20

Group II: Claims 4, 5, 11, 12, 21, and 22

Group III: Claims 6, 7, 13, 14, 23, 24, 30, and 31

With respect to Issue D, claims within each Group stand or fall together with the other claims of that Group. However, each Group of claims does not stand or fall together with any other Group of claims.

ISSUE E:

Group I: Claims 15, 17, 32 and 34

Group II: Claims 16 and 33

With respect to Issue E, claims within each Group stand or fall together with the other claims of that Group. However, each Group of claims does not stand or fall together with any other Group of claims.

8. ARGUMENTS

A. ISSUE A

Claims 8 to 17 stand finally rejected under 35 U.S.C. § 112 second paragraph as allegedly indefinite. It is respectfully submitted that claims 8 to 17 are not indefinite for the following reasons.

Claims 8 to 17 were finally rejected under 35 U.S.C. § 112, second paragraph as allegedly "vague and indefinite for the reasons noted in paper no 6 (3-27-02)." Final Office Action at p. 2. The Office Action of March 27, 2002 states at page 2 that "[t]hese claims are vague and indefinite in that they purpose [sic] to be drawn to a method for charging but no process or method steps are claimed." The Final Office Action alleges that "no specific recognizable steps are claimed." The Final Office Action also alleges that "[c]laims 8-17 are nothing more than a vague collection of ideas with no definite

steps" and that "[o]ne of ordinary skill in the art could not determine the meters [sic] or boards [sic] of these 'method' claims." Final Office Action at p. 2.

The second paragraph of 35 U.S.C. § 112 merely requires that "the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity." M.P.E.P. § 2173.02 (emphasis added). Moreover, the "focus during examination of claims for compliance with the requirement for definiteness of 35 U.S.C. 112, second paragraph is whether the claim meets the threshold requirements of clarity and precision, not whether more suitable language or modes of expression are available." Id. Indeed, "[s]ome latitude in the manner of expression and the aptness of terms should be permitted," and "Examiners . . . should not reject claims or insist on their own preferences if other modes of expression selected by applicants satisfy the statutory requirement." Id.

It is respectfully submitted that claims 8 to 17 fully comply with the requirements of 35 U.S.C. § 112. For example, claim 8, line 2 recites that "a definition is made," which is believed and respectfully submitted to sufficiently set forth a method step. Claim 12, line 2 recites that a "control unit (D) determines that correction factor," which is also believed and respectfully submitted to sufficiently set forth a method step. Claim 13 recites that "the control unit determines the correction factor," claim 14 recites that "the normal travel distance and the respective actual travel distance are measured," claim 15 recites that "the correction factor is measured," and claim 16 recites that "the correction factor is stored." All of the foregoing limitations are believed and respectfully submitted to sufficiently set forth method steps and do not constitute a "vague collection of ideas with no definitive steps" as alleged in the Final Office Action. It is therefore respectfully submitted that claims 8 to 17 fully comply with the requirements of 35 U.S.C. § 112, and it is respectfully requested that this rejection be reversed.

B. ISSUE B

Claims 1, 3, 4, 18, 20, 21, and 25 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by Hirotada et al. or Katsuhiro et al. It is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claims 1, 3, 4, 18, 20, 21, and 25 for the following reasons.

Hirotada et al. purport to relate to a piezoelectric-element driving device, and Katsuhiro et al. purport to relate to a control circuit for a piezoelectric actuator. As regards the present rejection, the Final Office Action states:

> Claims 1, 3, 4, 18, 20, 21 and 25 are rejected under 35 U.S.C. 102 as anticipated by [Hirotada et al.] or [Katsuhiro et al.]. It is noted that these references were also applied as anticipatory references by the European Search Authority in the Search Report submitted by applicants on 7-9-01. (See the English language abstract) a control circuit for driving a piezo-electric element while compensating for changes caused by ageing, temperature, etc. etc. [sic] <u>Any</u> defect or abnormality would be compensated, including those perceived to originate in the manufacturing process. Thus without specific mention of changes in thickness due to e.g. manufacturing defects, these references inherently compensate for such variatings [sic] by the apparatus and method as disclosed. Note claim [sic] 18 and 1 merely call for apparatus "characterized" or "configured" to perform a desired function. Structurally they only define a piezo-electric actuator and <u>any</u> drive circuit. These narrative type claims, not using "means plus function" language thus would not define from the references even if the references didn't show the desired function noted in applicants [sic] claims. (Emphasis in original).

As an initial matter, whether certain patents or printed publications were cited in the search report submitted on July 6, 2001 is not dispositive on the issue of the patentability of any claims of the present application.

While the Final Office Action appears to be referring to the English-language abstract of only one of

Hirotada et al. and Katsuhiro et al., no clarification is made as to which, if any, is being relied on in the Final Office Action. Furthermore, neither Hirotada et al. nor Katsuhiro et al. provides a description in which any possible defect or abnormality is compensated for, including those perceived to originate in the manufacturing process, as alleged in the Final Office Action.

Notwithstanding the above, to facilitate the proceedings, the merits of these rejections are addressed below to the extent possible despite the lack of clarity of the rejections.

1. <u>GROUP I - CLAIMS 1 AND 18</u>

Claim 1 relates to an apparatus for charging a piezoelectric element. Claim 1 recites that an activation voltage and an activation charge value for driving the piezoelectric element are controlled online by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element layer thickness or the number of layers.

Claim 18 relates to an apparatus for charging a piezoelectric element and recites that the apparatus includes a control unit configured to control an activation voltage and an activation charge value to drive the piezoelectric element, the control unit configured to adjust the activation voltage and activation charge value to compensate for a deviation caused by a variation of at least one of a layer thickness of the piezoelectric element and a number of layers of the piezoelectric element.

To the extent that the rejection is understood, the Examiner appears to be relying on the doctrine of inherency, even though the references fail to describe features recited in the rejected claims, such as compensating for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. However, to the extent the Examiner is relying on the doctrine of inherency, the Examiner

must provide a "basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristics necessarily flows from the teachings of the applied art." See M.P.E.P. § 2112; emphasis in original; and see, Ex parte Levy, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). Thus, the M.P.E.P. and the case law make clear that simply because a certain result or characteristic may occur in the prior art does not establish the inherency of that result or characteristic. That is, "[i]nherency . . . may not be established by probabilities or possibilities," and "[t]he mere fact that a certain thing may result from a given set of circumstances is not sufficient." In re Robertson, 49 U.S.P.Q.2d 1949, 1951 (Fed. Cir. 1999) (quoting In re Oelrich, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981)). The Examiner did not present any basis in fact or technical reasoning to support his reliance on this doctrine. It is respectfully submitted that these features are not inherent, and that the disclosures of the cited references do not disclose, or even suggest, these features, as more fully set forth below.

It is "well settled that the burden of establishing a prima facie case of anticipation resides with the [United States] Patent and Trademark Office." Ex parte Skinner, 2 U.S.P.Q.2d 1788, 1788 to 1789 (Bd. Pat. App. & Inter. 1986) (citing In re Piasecki, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984). To anticipate a claim, each and every element as set forth in the claim must be found in a single prior art reference. Verdegaal Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). That is, the prior art must describe the elements arranged as required by the claims. In re Bond, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990).

Non of the Office Actions to date has not presented evidence showing that either Hirotada et al. or Katsuhiro et

al. discloses all of the features of claims 1 and 18, in as complete detail as is contained in claims 1 and 18. The Final Office Action merely offers the unsupported assertion that even "without specific mention of changes in thickness" and "even if the references didn't show the desired function," these references inherently disclose these features. These statements made may be considered as virtual admissions that these details are not disclosed in the references, and it is respectfully submitted that Appellants believe that these details are not disclosed in the references. Accordingly, each and every element as set forth in claims 1 and 18 cannot be found in either Hirotada et al. or Katsuhiro et al.

More specifically, Hirotada et al. purport to relate to a piezoelectric-element driving device that compensates for the change in expansion amount of a piezoelectric element caused with the change in time and temperature. Abstract. Hirotada et al. state that an expansion amount of a charged piezoelectric element is detected and compared with an specified reference value. Constitution. When the expansion amount reaches the reference value a voltage is held across both ends of the piezoelectric element. Id. The output is monitored and connected to a fail safe device. Id.

Therefore, Hirotada et al. appear to describe a system that merely responds to changes in the amount of expansion detected in the piezoelectric element due to use and age. Hirotada et al. attribute these changes to "change with time, temperature change and the like." Abstract. In contrast, claims 1 and 18 relate to deviations caused by variations in the piezoelectric element's layer thickness or/and the number of layers. While these deviations may also change with respect to the passage of time or a change in temperature, these deviations are also present in the absence of time and temperature changes. The deviations of the claims are due to "manufacturing variation[s]." See Specification, page 1, lines 10 to 11 and page 4, line 22. Therefore, even before the passage of time or even without any change in temperature, the deviations recited in claims 1 and 18 will still be present in

the piezoelectric element. In contrast, Appellants believe that the changes apparently described in Hirotada et al. are changes that only appear, as stated by Hirotada et al., after the passage of time or after temperature changes have affected the piezoelectric element. The difference is important in that the changes apparently described in the Hirotada et al. are not the same as the deviations recited in claims 1 and 18.

Katsuhiro et al. purport to relate to a control circuit for a piezoelectric actuator to drive a multitude of piezoelectric actuators. Abstract. A small number of power sources are connected a capacitor in parallel to the piezoelectric actuators. Id. It appears that Katsuhiro et al. merely describe a circuit in which the positions of a set of piezoelectric actuators is monitored and fed to a controller. Constitution. When the position signal coincides with a set value and electric charge is accumulated in the capacitor, changeover switches are switched to the next set of piezoelectric actuators. Id. Therefore, it is believed that the circuit of Katsuhiro et al. does not relate to the features of claims 1 and 18.

In summary, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, that an activation voltage and an activation charge value for driving the piezoelectric element are controlled by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness and/or the number of layers, as recited in claims 1 and 18.

Therefore, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, all of the limitations of claims 1 and 18. It is therefore respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claims 1 and 18, and it is respectfully requested that the final rejection of these claims be reversed.

2. GROUP II - CLAIMS 3, 4, 20 AND 21

Claims 3 and 4 ultimately depend from claim 1 and therefore include all of the limitations of claim 1. Accordingly, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates these dependent claims for at least the same reasons given above in support of the patentability of claim 1.

Claims 20 and 21 ultimately depend from claim 18 and therefore include all of the limitations of claim 18. Accordingly, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates these dependent claims for at least the same reasons given above in support of the patentability of claim 18.

Regarding claims 3 and 20, these claims further recite that the activation voltage value and the activation charge value are determined as a function of the piezoelectric element's normal voltage, normal charge and a correction factor. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that a correction factor is disclosed by Hirotada et al. or Katsuhiro et al., and it is respectfully submitted that a correction factor is not disclosed, or even suggested, by Hirotada et al. or Katsuhiro et al. Furthermore, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, that a correction factor is used to calculate an activation voltage value and an activation charge value, as recited in claims 3 and 20.

Regarding claims 4 and 21, these claims further recite that the correction factor is a function of a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that this feature is disclosed by either Hirotada et al. or Katsuhiro et al., and it is respectfully submitted that this feature is not disclosed, or even suggested, by either Hirotada et al. or Katsuhiro et al.

In summary, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, all of the limitations of claims 3, 4, 20, and 21. It is, therefore, respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claims 3, 4, 20, and 21, and it is respectfully requested that the final rejection of these claims be reversed.

3. GROUP III - CLAIM 25

Claim 25 relates to a method for charging a piezoelectric element and recites that the method includes defining, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element.

As more fully set forth above, Hirotada et al. appear to describe a system that merely responds to changes in the amount of expansion detected in the piezoelectric element due to use and age. However a batch variation, as described in the Specification of the present invention, is "due to variations in the layer thickness or number of layers" of the piezoelectric element. Specification, page 27, lines 16 to 25. As described in more detail above, the changes in the amount of expansion detected in the piezoelectric element due to use and age, as stated in Hirotada et al., are not the same as the batch variations, as recited in claim 25, which are due to variations in the layer thickness or number of layers.

As more fully set forth above, Katsuhiro et al. appear to describe a circuit in which the position of a set of piezoelectric actuators is monitored and fed to a controller, such that when the position signal coincides with a set value and electric charge is accumulated in a capacitor, changeover switches are switched to the next set of piezoelectric actuators. It is respectfully submitted that the circuit of Katsuhiro et al. does not relate to the features of claim 25.

Therefore, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even

suggests, a method for charging a piezoelectric element in which a definition is made, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element, as recited in claim 25.

In summary, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, all of the limitations of claim 25. It is therefore respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claim 25, and it is respectfully requested that the final rejection of claim 25 be reversed.

C. <u>ISSUE C</u>

Claims 1, 2, 8, 9, 18, 19, 25, and 26 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by Moloney. It is respectfully submitted that Moloney does not anticipate claims 1, 2, 8, 9, 18, 19, 25, and 26 for the following reasons.

1. <u>GROUP I - CLAIMS 1, 2, 18, AND 19</u>

Moloney purports to relate to a valve operating mechanism for internal combustion and like valved engines. As regards the present rejection, the Final Office Action states that:

> Moloney teaches providing a feedback loop to control the charging of a piezo injector. Travel distance is measured and compensated for if it isn't equal to a desired valve [sic] this on-line compensation is constant as conditions charge e.g. were, temperature flection [sic] etc. Thus any abnormalities of piezo expansion and contraction requiring compensation are addressed and corrected.

Final Office Action at p. 3.

However, it is respectfully submitted that Moloney does not disclose, or even suggest, an apparatus for charging a piezoelectric element in which an activation voltage and an activation charge value for driving the piezoelectric element

is controlled online by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness and/or the number of layers, as recited in claims 1 and 18.

Moloney states that Figure 3 includes a "piezo-electric feedback loop control circuit." Col. 3, lines 26 to 27. Of this feedback, Moloney merely states, "the circuit provides for a loop control system so that the movement transmitted by the piezoelectric device(s) to the valve is sensed and any deviation from the correct movement is corrected by means of the control circuit." Col. 3, lines 30 to 35. As stated above, to anticipate a claim, "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim," <u>Richardson v. Suzuki Motor Co.</u>, <u>supra</u>, and the prior art must describe the elements arranged as required by the claims, <u>In re Bond</u>, <u>supra</u>.

It is respectfully submitted that Moloney does not present ***each and every element*** of claim 1 in ***as complete detail*** as is contained in claim 1. For example, Moloney states that deviation from correct movement is corrected. However, claim 1 includes the detail that deviations caused by variations in the piezoelectric element's layer thickness or the number of layers are compensated for. Claim 18 includes analogous limitations. This additional detail is important because it distinguishes between the types of changes caused by age of the piezoelectric device, from the deviations caused by manufacturing variations. Moloney appears to be describing the former -- that is, changes caused by age of the piezoelectric device -- because there is no inherent correct positioning of a piezoelectric device that is established during its manufacture. It appears that the positioning deviations would arise after the piezoelectric device has been placed in a particular position and operated for a period of time, such that changes in current positioning relative to its initial positioning may be observed. Therefore, the deviation

of correct positioning stated in Moloney is not the same as the deviations caused by variations in the piezoelectric element's layer thickness and/or the number of layers, as recited in claims 1 and 18.

In summary, is respectfully submitted that Moloney does not disclose, or even suggest, all of the features of claim 1 and 18 and, therefore, does not anticipate claims 1 and 18.

As for claims 2 and 19, claim 2 depends from claim 1 and therefore includes all of the features of claim 1, and claim 19 depends from claim 18 and therefore includes all of the features of claim 18. It is, therefore, respectfully submitted that claim 2 is not anticipated by Moloney for at least the same reasons given above in support of claim 1 and that claim 19 is not anticipated by Moloney for at least the same reasons given above in support of claim 18.

Therefore, it is respectfully submitted that Moloney does not disclose, or even suggest, all of the limitations of claims 1, 2, 18 and 19. It is therefore respectfully submitted that Moloney does not anticipate claims 1, 2, 18 and 19, and it is respectfully requested that the final rejection of claims 1, 2, 18 and 19 be reversed.

2. GROUP II - CLAIMS 8, 9 AND 25

As stated above, Moloney merely states that deviation from correct movement is corrected. However, claims 8 and 25 include the limitation that a definition is made, prior to charging, of certain values as a function of batch variation. Therefore, the deviation of correct positioning stated in Moloney is not the same as the deviations caused by the batch variation, as recited in claims 8 and 25.

Furthermore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Moloney discloses that a definition is made ***prior to charging***, as recited in claims 8 and 25, and it is respectfully

submitted that this feature is not disclosed, or even suggested, by Moloney.

In summary, is respectfully submitted that Moloney does not disclose all of the features of claims 8 and 25 and therefore does not anticipate claims 8 and 25.

As for claim 9, claim 9 depends from claim 8 and therefore includes all of the features of claim 8. It is, therefore, respectfully submitted that claim 8 is not anticipated by Moloney for at least the same reasons given above in support of claim 9.

Therefore, it is respectfully submitted that Moloney does not disclose all of the limitations of claims 8, 9 and 25. It is therefore respectfully submitted that Moloney does not anticipate claims 8, 9 and 25, and it is respectfully requested that the final rejection of claims 8, 9 and 25 be reversed.

3. GROUP III - CLAIM 24

Claim 24 ultimately depends from 18. Accordingly, claim 24 includes all of the limitations of claim 18. Therefore, it is respectfully submitted that Moloney does not anticipate claim 24 for at least the same reasons given above in support of the patentability of claim 18.

Furthermore, as stated above, Moloney merely states that deviation from correct movement is corrected. However, claim 24 includes the limitation that an arrangement configured to measure the normal travel distance and the actual travel distance of the piezoelectric element ***at substantially a same temperature***. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Moloney discloses this feature, and it is respectfully submitted that Moloney does not disclose, or even suggest, this feature.

Therefore, it is respectfully submitted that Moloney does not disclose all of the limitations of claim 24. It is therefore respectfully submitted that Moloney does not

anticipate claim 24, and it is respectfully requested that the final rejection of claim 24 be reversed.

D. ISSUE D

Claims 3 to 7, 10 to 14, 20 to 24, 30, and 31 stand finally rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and Takada et al. or Jaenker. It is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious claims 3 to 7, 10 to 14, and 32 to 34 for the following reasons.

As an initial matter the Final Office Action states that "[c]laims 3-7, 10-14, 20-24 and 10-31 are rejected under 35 U.S.C. 103 as unpatentable over Moloney in view of Takada or Jaenker for the explicit reasons set forth in paper no 6 (3-37-02) [*sic*]." Final Office Action at page 3. It is believed that "10-31" is a typographic error and that what was meant was "30-31."

The Office Action of March 27, 2002 includes a rejection of claims "3-7 and 10-14" under 35 U.S.C. § 103(a) as unpatentable over "Moloney ***or Mitsuyasu*** in view of Takada or Jaenker." Regarding Moloney, the Office Action of March 27, 2002 states that "Moloney ***and Mitsuyasu*** teach compensating a stack of piezoelectric elements in a fuel injector for travel distance based on variation, between actual and ideal conditions" but provides no support for such assertion. Therefore, reference is made to Mitsuyasu, even though the present rejection is based on **only** on the combination of Moloney and Takada et al. or Jaenker. Neither the present Final Office Action nor the Office Action of March 27, 2002 specifies which features of which claims are purported to be disclosed by Moloney, as opposed to those allegedly disclosed by Mitsuyasu, which is no longer relied upon, to form the basis for this rejection. Furthermore, no grounds are provided in either the Office Action of March 27, 2002 or the Final Office Action, on which to base the rejection of claims 20 to 24 and 30 and 31.

The case of In re Wilke, supra, explained that a claim rejection violates 35 U.S.C. § 132 if it is so uninformative that it prevents the applicant from recognizing and seeking to counter the grounds for rejection. It is respectfully submitted that the claim rejections in this section are so uninformative as to violate 35 U.S.C. § 132. Furthermore, as provided in the cases of In re Herrick, 145 U.S.P. 400 (C.C.P.A. 1965) and Ex parte Blanc, 13 U.S.P.Q.2d 1383 (Bd. Pat. App. & Inter. 1989), the form of the present rejection "Moloney in view of Takada [et al.] or Jaenker" constitutes a procedural failure to establish a prima facie case of obviousness since "[a] rejection so stated defeats the intent and purpose of 35 U.S.C. 132." Ex parte Blanc, 13 U.S.P.Q.2d at 1385 (quoting In re Herrick, supra). Therefore it is respectfully requested that the rejection of these claims be reversed for at least the above reasons.

Notwithstanding the above, to facilitate the proceedings, the merits of these rejections are addressed below to the extent possible despite the lack of clarity of the rejections.

As an initial matter, obviousness must be determined with reference to that which would have been obvious to one of ordinary skill in the art at the time the invention was made. Environmental Designs, Ltd. v. Union Oil Co., 713 F.2d 693, 218 U.S.P.Q. 865 (Fed. Cir. 1983), cert. denied, 464 U.S. 1043 (1984). None of the Office Actions to date even allege that it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify or combine the cited references. Indeed, the Office Action of March 27, 2002 merely alleges that "[i]t would have been obvious to one of ordinary skill in the are [*sic*] to select from among known compensation techniques and thus to use voltage factors in the devices of Moloney or Mitsuyasu." Office Action of March 27, 2002 at p. 3. Therefore, this rejection appears to be based on improper hindsight reasoning since the rejection is not even based on what would have been obvious to one of ordinary skill in the art at the time the invention was made.

The cases of In re Fine, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988) and In re Jones, 21 U.S.P.Q.2d 1941 (Fed. Cir. 1992), make plain that the Office Actions' generalized assertions that it would have been obvious to modify or combine the references do not properly support a § 103 rejection. It is respectfully submitted that those cases make plain that the rejection in the Final Office Action reflects a subjective "obvious to try" standard, and therefore does not reflect the proper evidence to support an obviousness rejection based on the references relied upon. In particular, the Court in the case of In re Fine stated that:

> The PTO has the burden under section 103 to establish a *prima facie* case of obviousness. It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. This it has not done. . . .
>
> **Instead, the Examiner relies on hindsight in reaching his obviousness determination. . . . One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.**

In re Fine, 5 U.S.P.Q.2d at 1598 to 1600 (citations omitted; italics in original; emphasis added). Likewise, the Court in the case of In re Jones stated that:

> Before the PTO may combine the disclosures of two or more prior art references in order to establish *prima facie* obviousness, there must be some suggestion for doing so, found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. . . .
>
> **Conspicuously missing from this record is any evidence, other than the PTO's speculation (if it be called evidence) that one of ordinary skill . . . would have been motivated to make the modifications . . . necessary to arrive at the claimed [invention].**

In re Jones, 21 U.S.P.Q.2d at 1943, 1944 (citations omitted; italics in original).

That is exactly the case here since it is believed and respectfully submitted that the Final Office Action offers no evidence whatsoever, but only conclusory hindsight, reconstruction and speculation, which these cases have indicated does not constitute evidence that will support a proper obviousness finding. Unsupported assertions are not evidence as to why a person having ordinary skill in the art at the time of the invention would be motivated to modify or combine references to provide the claimed subject matter of the claims to address the problems met thereby. Accordingly, the Office has not provided proper evidence of a motivation for modifying or combining the references to provide the claimed subject matter.

More recently, the Federal Circuit in the case of In re Kotzab has made plain that even if a claim concerns a "technologically simple concept" -- which is not the case here -- there still must be some finding as to the "specific understanding or principle within the knowledge of a skilled artisan" that would motivate a person having no knowledge of the claimed subject matter to "make the combination in the manner claimed," stating that:

> In this case, the Examiner and the Board fell into the hindsight trap. The idea of a single sensor controlling multiple valves, as opposed to multiple sensors controlling multiple valves, is a technologically simple concept. With this simple concept in mind, the Patent and Trademark Office found prior art statements that in the abstract appeared to suggest the claimed limitation. But, there was no finding as to the specific understanding or principle within the knowledge of a skilled artisan that would have motivated one with no knowledge of Kotzab's invention to make the combination in the manner claimed. In light of our holding of the absence of a motivation to combine the teachings in Evans, we conclude that the Board did not make out a proper prima facie case of obviousness in rejecting [the] claims . . . under 35 U.S.C. Section 103(a) over Evans.

In re Kotzab, 55 U.S.P.Q.2d 1313, 1318 (Fed. Cir. 2000) (emphasis added). Again, it is believed that there have been no such findings and it is respectfully submitted that no such finding have been offered in either the Office Action of March 27, 2002 or the Final Office Action.

Of course, in rejecting a claim under 35 U.S.C. § 103(a), the Examiner bears the initial burden of presenting a prima facie case of obviousness. In re Rijckaert, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). To establish prima facie obviousness, three criteria must be satisfied. First, there must be some suggestion or motivation to modify or combine reference teachings. In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). This teaching or suggestion to make the claimed combination must be found in the prior art and not based on the application disclosure. In re Vaeck, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Second, there must be a reasonable expectation of success. In re Merck & Co., Inc., 800 F.2d 1091, 231 U.S.P.Q. 375 (Fed. Cir. 1986). Third, the prior art reference(s) must teach or suggest all of the claim limitations. In re Royka, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). As indicated above, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 3 to 7, 10 to 14, 20 to 24, 30 and 31.

It is therefore, respectfully submitted that a proper prima facie case of obviousness has not been presented, and it is respectfully requested that the final rejection of these claims be reversed for at least the above reasons.

1. GROUP I - CLAIMS 3, 10, and 20

Claim 3 ultimately depends from claim 1 and therefore include all of the limitations of claim 1, claim 10 ultimately depends from claim 8 and therefore includes all of the limitations of claim 8, and claim 20 depends from claim 18 and therefore includes all of the limitations of claim 18. As more fully set forth above with respect to claims 1, 8 and 18,

it is respectfully submitted that Moloney does not disclose, or even suggest, all of the limitations of claims 1 and 18, such as compensating for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. Additionally, Moloney does not disclose, or even suggest, all of the limitations of claims 8, such as that a definition is made, prior to charging, of certain values as a function of batch variation in the travel of the piezoelectric element. Therefore, it is respectfully submitted that claim 3 is patentable over Moloney for at least the same reasons given above in with respect to claim 1, claim 10 is patentable over Moloney for at least the same reasons given above in with respect to claim 8, and claim 20 is patentable over Moloney for at least the same reasons given above in with respect to claim 18.

Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Takada et al. or Jaenker disclose the above features of the claims that are not disclosed by Moloney, and it is respectfully submitted that neither Takada et al. nor Jaenker discloses, or even suggests, the above features of the claims that are not disclosed by Moloney.

Furthermore, claims 3, 10 and 20 further recite that the control unit determines the activation voltage value and the activation charge values respectively as a function of the piezoelectric element's normal voltage, normal charge and a correction factor.

The Office Action of March 27, 2002 contends that "Takada [et al.] and Jaenker teach measuring the relationship between voltage and displacement and thus obtaining a correction factor" but provides no support for this assertion. However, even though Appellants do not necessarily agree with this assertion, even if it were true, it still would not provide a basis for rejection of the claims. This assertion only states that the references purportedly disclose that a correction factor is derived from a relationship between voltage and displacement. However, claims 3, 10 and 20 recite

that three characteristics of the piezoelectric element are taken into account in determining the activation values: the piezoelectric element's normal voltage, normal charge and a correction factor. As stated above in the section summarizing the invention, the correction factor is not based on a simple relationship between voltage and displacement. The specification provides, regarding calculation of the correction factor:

> While it is possible to obtain a full range of data for the lifting (h_{actual}) as a function of voltage, it would require taking repetitive measurements which may be unnecessary. Accordingly, for this measurement only the lifting for the maximum voltage U_{max} can be measured. That is, for this measurement only U_{norm} would be equal to U_{max}. For all other applications U_{norm} is considered to be the voltage which is applied to an ideal piezoelectric element as a target voltage for a certain lift without taking into account any correction values.

Specification, page 28, lines 4 to 12.

The correction factor of the present claims takes into account features including the number of layers of the multi-layer piezoelectric element, the voltage applied before any correction, and the lifting distance as measured directly after manufacturing of the piezoelectric element. Specification, page 27, line 32 to page 28, line 3. It is noted that these are measurements representing "variations in the piezoelectric element's layer thickness or the number of layers" (as recited in claims 1, 8, and 18, from which claims 3, 10, and 20 respectively depend) which are used in deriving the activation values which compensate for the deviations. Therefore, the correction factor of the assertions contained in the Office Action of March 27, 2002 is not the same as and does not correspond to the correction factor of the present invention, as recited in the claims.

Therefore, even if the Office Actions' assertion is correct, and Appellants do not necessarily agree that it is, the combination of Moloney and Takada et al. or Jaenker still

does not disclose all of the features of the claims. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Takada et al. or Jaenker discloses using a ***normal voltage***, a ***normal charge***, and a correction factor in determining activation values, as recited in claims 3, 10, and 20, and it is respectfully submitted that these references do not disclose, or even suggest, the above features of claims 3, 10, and 20.

As understood, Takada et al. relate to a method and device for driving piezoelectric elements in a micromotion mechanism, in which a linear or a quadratic expression characterizing the displacement of the piezoelectric element per unit voltage in various voltage ranges is employed. Col. 3 line 64 to col. 4, line 33. Jaenker, as understood, relates to a method for calibrating a piezoelectric actuation drive by mathematically interpolating a function relating "displacement positions of an actuator beam 4 [which is moved via the piezoelectric element] between stops 9A and 9B, as a function of the applied energizing voltage." Col. 4, lines 38 to 43.

Therefore, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, that a normal voltage, a normal charge, and a correction factor are used in determining activation values, as recited in claims 3, 10, and 20.

Accordingly, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 3, 10 and 20. It is, therefore, respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious claims 3, 10 and 20, and it is respectfully requested that the final rejection of these claims be reversed.

2. <u>GROUP II - CLAIMS 4, 5, 11, 12, 21, AND 22</u>

Claims 4 to 5 depend from claim 3 and ultimately depend from claim 1 and therefore include all of the

limitations of claims 1 and 3, claims 11 to 12 depend from claim 10 and ultimately depend from claim 8 and therefore include all of the limitations of claim 8 and 10, and claims 21 to 22 depend from claim 20 and ultimately depend from claim 18 and therefore include all of the limitations of claims 18 and 20. As more fully set forth above with respect to claims 1, 3, 8, 10, 18, and 20, the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of these claims.

Therefore, it is respectfully submitted that claims 4 to 5 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claims 1 and 3, that claims 11 to 12 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claim 8 and 10, and that claims 21 to 22 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claim 18 and 20.

Furthermore, claims 4, 11, and 21 further recite that the correction factor is a function of a piezoelectric element's normal travel distance and the piezoelectric element's respective actual travel distance. As more fully set forth above, the Office Action of March 27, 2002 alleges at p. 3 that Takada et al. and Jaenker disclose "measuring the relationship between voltage and displacement and thus obtaining a correction factor." Therefore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses a correction factor that is a function of a piezoelectric element's normal travel distance and the piezoelectric element's respective actual travel distance, as recited in claims 4, 11, and 21, and it is respectfully submitted that these features of claims 4, 11, and 21 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker.

Claims 5, 12, and 22 depend respectively from claims 4, 11, and 21 and are therefore patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in support of the patentability of claims 4, 11, and 21.

Additionally, claims 5, 12, and 22 further recite that the control unit determines the correction factor by dividing the piezoelectric element's normal travel distance by the piezoelectric element's respective actual travel distance. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses that the control unit determines the correction factor by dividing the piezoelectric element's normal travel distance by the piezoelectric element's respective actual travel distance, as recited in claims 5, 12, and 22, and it is respectfully submitted that these features of claims 5, 12, and 22 are not disclosed, or even suggested, by the references.

In summary, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 4 to 5, 11 to 12, and 21 to 22. It is therefore respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious 4 to 5, 11 to 12, and 21 to 22, and it is respectfully requested that the final rejection of these claims be reversed.

3. GROUP III - CLAIMS 6, 7, 13, 14, 23, 24, 30 AND 31

Claims 6 to 7 depend from claim 3 and ultimately depend from claim 1 and therefore include all of the limitations of claims 1 and 3, claims 13 to 14 depend from claims 10 and ultimately depend from claim 8 and therefore include all of the limitations of claim 8 and 10, and claims 23 to 24 depend from claim 20 and ultimately depend from claim 18 and therefore include all of the limitations of claims 18 and 20. Claims 30 and 31 ultimately depend from claim 25,

which includes subject matter similar to claim 8. Claims 30 and 31 depend from claim 27, which includes subject matter similar to claim 10. As more fully set forth above with respect to claims 1, 3, 8, 10, 18, and 20, the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of these claims, nor claims 25 and 27, which recite similar subject matter.

Therefore, it is respectfully submitted that claims 6 to 7 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claims 1 and 3, that claims 13 to 14 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claim 8 and 10, that claims 23 to 24 are patentable over the combination of Moloney and Takada et al.. or Jaenker for at least the same reasons given above in with respect to claim 18 and 20, and that claims 30 and 31 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claims 25 and 27.

Furthermore, claims 6, 13, 23, and 30 further recite that the control unit determines the correction factor as a function of temperature. As more fully set forth above, the Office Action of March 27, 2002 merely alleges at p. 3 that Takada et al. and Jaenker disclose "measuring the relationship between voltage and displacement and thus obtaining a correction factor." Therefore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses that the control unit determines the correction factor as a function of temperature, as recited in claims 6, 13, 23, and 30 and it is respectfully submitted that these features of claims 6, 13, 23, and 30 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker.

Claims 7, 14, and 24 depend respectively from claims 5, 12, 22, and are therefore patentable over the combination

of Moloney and Takada et al. or Jaenker for at least the same reasons given above in support of the patentability of claims 5, 12, 22. Claim 31 depends from claim 30 and is therefore patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in support of the patentability of claim 30.

Additionally, claims 7, 14, 24, and 31 further recite the normal travel distance and the respective actual travel distance are measured at substantially the same temperature. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses that the normal travel distance and the respective actual travel distance are measured at substantially the same temperature, as recited in claims 7, 14, 24, and 31, and it is respectfully submitted that these features of claims 7, 14, 24, and 31 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker.

In summary, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 6 to 7, 13 to 14, 23 to 24, and 30 to 31. It is, therefore, respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious 6 to 7, 13 to 14, 23 to 24, and 30 to 31, and it is respectfully requested that the final rejection of these claims be reversed.

E. <u>ISSUE E</u>

Claims 15 to 17 and 32 to 34 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. It is respectfully submitted that claims 15 to 17 and 32 to 34 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. for the following reasons.

As an initial matter, it is respectfully submitted that this rejection is so uninformative as to violate 35

U.S.C. § 132. Furthermore, it is respectfully submitted that the form of the present rejection "Moloney in view of Takada [et al.] or Jaenker and combined with Baron [sic] or Estevenon [et al.]" constitutes a procedural failure to establish a prima facie case of obviousness since "[a] rejection so stated defeats the intent and purpose of 35 U.S.C. 132." Ex parte Blanc, 13 U.S.P.Q.2d at 1385 (quoting In re Herrick, supra). Therefore it is respectfully requested that the rejection of these claims be reversed for at least the above reasons.

Notwithstanding the above, to facilitate the proceedings, the merits of these rejections are addressed below to the extent possible despite the lack of clarity of the rejections.

1. **GROUP I - CLAIMS 15, 17, 32, AND 34**

Claims 15 and 17 depend from claim 10 and ultimately depend from claim 8 and therefore include all of the limitations of claims 8 and 10, and claims 32 to 34 depend from 27 and ultimately depend from claim 25 and therefore include all of the limitations of claims 25 and 27. As more fully set forth above with respect to claims 8, 10, 25, and 27, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 8, 10, 25 and 27.

Therefore, it is respectfully submitted that claims 15 and 17 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. for at least the same reasons given above in with respect to claims 8 and 10, and claims 32 and 34 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. for at least the same reasons given above with respect to claim 25 and 27.

Furthermore, claims 15 and 32 further recite that the correction factor is measured as a part of the manufacturing process. In support of this rejection, the Office Action of March 27, 2002 states, at page 3:

> These claims add that an EEPROM is used to record manufacturing history developed correction factors. Each of Barron and Estevnon [sic] teach using an EEPROM to record the history of each value of an injector system.

The Final Office Action merely refers to the Action of March 27, 2002 with respect to this rejection.

Therefore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that either Barron or Estevenon et al. discloses that the correction factor is measured as a part of the manufacturing process, as recited in claims 15 and 32, and it is respectfully submitted that these features of claims 15 and 32 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. Claims 17 and 34 depend respectively from claims 15 and 32 and therefore include all of the features of these claims.

In summary, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. does not disclose, or even suggest, all of the limitations of claims 15, 17, 32, and 34. It is therefore respectfully submitted that the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. does not render obvious 15, 17, 32, and 34, and it is respectfully requested that the final rejection of these claims be reversed.

2. <u>GROUP II - CLAIMS 16 AND 33</u>

Claim 16 depends from claim 10 and ultimately depends from claim 8 and therefore includes all of the limitations of claims 8 and 10, and claim 33 depends from claim 27 and ultimately depends from claim 25 and therefore includes all of the limitations of claims 25 and 27. As more fully set forth above with respect to claims 8, 10, 25, and 27, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or

even suggest, all of the limitations of claims 8, 10, 25 and 27.

Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that either Barron or Estevenon et al. discloses the features of these claims that were not disclosed by the combination of Moloney and Takada et al. or Jaenker, and it is respectfully submitted that these features of the claims are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. Therefore, it is respectfully submitted that claims 16 and 33 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al., for at least the reasons stated above, and it is respectfully requested that the final rejection of these claims be reversed.

9. CONCLUSION

For at least the reasons indicated above, Appellants respectfully submits that the art of record does not teach or suggest Appellants' invention as recited in the claims of the above-identified application. Accordingly, it is respectfully submitted that the invention recited in the claims of the present application is new, non-obvious and useful. Reversal of the Examiner's rejection of the claims is therefore respectfully requested.

Respectfully submitted,

Dated: October 10, 2003 By: [signature]

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APPENDIX

1. An apparatus for charging a piezoelectric element (10, 20, 30, 40, 50 or 60), characterized in that an activation voltage and an activation charge value for driving the piezoelectric element (10, 20, 30, 40, 50 or 60) is controlled online by a control unit (D) which adjusts the activation voltage (U) and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's (10, 20, 30, 40, 50 or 60) layer thickness or the number of layers.

2. The apparatus as defined in claim 1, characterized in that the piezoelectric element (10, 20, 30, 40, 50 or 60) is an actuator in a fuel injection system.

3. The apparatus of claim 1, characterized in that the control unit determines the activation voltage value and the activation charge values respectively as a function of the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal voltage, normal charge and a correction factor.

4. The apparatus of claim 3, characterized in that the correction factor is a function of a piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance and the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

5. The apparatus of claim 4, characterized in that the control unit determines the correction factor by dividing the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance by the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

6. The apparatus of claim 3, characterized in that the control unit (D) determines the correction factor as a function of temperature.

7. The apparatus of claim 5, characterized in that the normal travel distance and the respective actual travel distance are measured at substantially the same temperature.

8. A method for charging a piezoelectric element (10, 20, 30, 40, 50 or 60), characterized in that a definition is made, prior to charging, as to a value for an activation voltage (U) and a value for an activation charge of the piezoelectric element (10, 20, 30, 40, 50 or 60) as a function of batch variation in the travel of the piezoelectric element (10, 20, 30, 40, 50 or 60).

9. The method as defined in claim 8, characterized in that the piezoelectric element (10, 20, 30, 40, 50 or 60) is an actuator in a fuel injection system.

10. The method as defined in claim 8, characterized in that the activation voltage and the activation charge values respectively, are a function of the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal voltage, the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal charge and a correction factor.

11. The method as defined in claim 10, characterized in that the correction factor is a function of the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance and the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

12. The method as defined in claim 11, characterized in that a control unit (D) determines that correction factor by dividing the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance to the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

13. The method as defined in claim 10, characterized in that the control unit determines the correction factor as a function of temperature.

14. The method as defined in claim 13, characterized in that the normal travel distance and the respective actual travel distance are measured at substantially the same temperature.

15. The method as defined in claim 10, characterized in that the correction factor is measured as a part of the manufacturing process.

16. The method as defined in claim 10, characterized in that the correction factor is stored for each cylinder within an EEPROM of the control unit (D).

17. The method as defined in claim 16, characterized in that the correction factor can be read from the EEPROM for test purposes.

18. An apparatus for charging a piezoelectric element, comprising:

a control unit configured to control an activation voltage and an activation charge value to drive the piezoelectric element, the control unit configured to adjust the activation voltage and activation charge value to compensate for a deviation caused by a variation of at least one of a layer thickness of the piezoelectric element and a number of layers of the piezoelectric element.

19. The apparatus according to claim 18, wherein the piezoelectric element includes an actuator in a fuel injection system.

20. The apparatus according to claim 18, wherein the control unit is configured to determine the activation voltage

and the activation charge value as a function of at least one of a normal voltage, a normal charge and a correction factor.

21. The apparatus according to claim 20, wherein the correction factor is a function of a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element.

22. The apparatus according to claim 21, wherein the control unit is configured to determine the correction factor in accordance with a division of the normal travel distance by the actual travel distance.

23. The apparatus according to claim 20, wherein the control unit is configured to determine the correction factor as a function of temperature.

24. The apparatus according to claim 22, further comprising an arrangement configured to measure the normal travel distance and the actual travel distance at substantially a same temperature.

25. A method for charging a piezoelectric element, comprising the step of defining, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element.

26. The method according to claim 25, wherein the piezoelectric element includes an actuator in a fuel injection system.

27. The method according to claim 25, wherein the activation voltage and the activation charge are a function of a normal voltage, a normal charge and a correction factor.

28. The method according to claim 27, wherein the correction factor is a function of a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element.

29. The method according to claim 28, further comprising the step of determining the correction factor by a control unit by dividing the normal travel distance by the actual travel distance.

30. The method according to claim 27, further comprising the step of determining the correction factor by a control unit as a function of temperature.

31. The method according to claim 30, further comprising the step of measuring a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element at substantially a same temperature.

32. The method according to claim 27, further comprising the step of measuring the correction factor as a part of a manufacturing process.

33. The method according to claim 27, further comprising the step of storing the correction factor for each cylinder within an EEPROM of a control unit.

34. The method according to claim 33, further comprising the step of reading the correction factor from the EEPROM for test purposes

[10744/4200]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Johannes-Joerg RUEGER et al.	Examiner: Mark O. Budd
For: COMPENSATION OF BATCH VARIATION IN THE TRAVEL DUE TO VARIATIONS IN THE LAYER THICKNESS OR NUMBER OF LAYERS IN MULTI-LAYER PIEZOELECTRIC ELEMENTS	
Filed: April 2, 2001	Art Unit ~~2632~~ 2834
Serial No.: 09/824,193	

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Date: October 10, 2003

Signature: Richard L. Mayer (Reg. No. 22,490)

Reg. No. 42,194

APPEAL BRIEF PURSUANT TO 37 C.F.R. § 1.192(a)

S I R:

In the above-identified patent application ("the present application"), Appellants mailed a Notice of Appeal on April 10, 2003 from the Final Office Action issued by the United States Patent and Trademark Office on October 10, 2002. In the Final Office Action, claims 1 to 34 were finally rejected. An Advisory Action was mailed on June 18, 2003.

In accordance with 37 C.F.R. § 1.192(a), this Appeal Brief is submitted in triplicate in support of the appeal of the final rejections of claims 1 to 34. For the reasons more fully set forth below, the final rejections of claims 1 to 34 should be reversed.

1. REAL PARTY IN INTEREST

The real party in interest in the present appeal is Robert Bosch GmbH of Stuttgart in the Federal Republic of Germany. Robert Bosch GmbH is the assignee of the entire right, title and interest in the present application.

2. RELATED APPEALS AND INTERFERENCES

There are no interferences or other appeals "which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal."

3. STATUS OF CLAIMS

Claims 8 to 17 stand finally rejected under 35 U.S.C. § 112 as indefinite.

Claims 1, 3, 4, 18, 20, 21, and 25 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by Japanese Published Patent Application No. 7-107753 ("Hirotada et al.") or Japanese Published Patent Application No. 63-167684 ("Katsuhiro et al.").

Claims 1, 2, 8, 9, 18, 19, 25 and 26 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by U. S. Patent No. 4,593,658 ("Moloney").

Claims 3 to 7, 10 to 14, 20 to 24, and 30 to 31 stand finally rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and U. S. Patent No. 5,384,507 ("Takada et al.") or U. S. Patent No. 6,340,858 ("Jaenker").

Claims 15 to 17 and 32 to 34 stand finally rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and Takada et al. or Jaenker and U.S. Patent No. 5,575,264 ("Barron") or U.S. Patent No. 6,247,451 ("Estevenon et al.").

A copy of the appealed claims is attached hereto in the Appendix.

4. **STATUS OF AMENDMENTS**

In response to the Final Office Action mailed on October 15, 2002, a Reply Under 37 C.F.R. § 1.116 was filed on February 21, 2003. No proposed amendments to the claims were presented in the Reply Under 37 C.F.R. § 1.116.

5. **SUMMARY OF THE INVENTION**

The present invention relates to an apparatus and a method for charging a piezoelectric element while compensating for deviations in the due to, for example, manufacturing variations in the piezoelectric elements. Specification, page 1, lines 9 to 11.

As noted in the Specification, in fuel injection systems, a goal is to achieve a desired fuel injection volume with high accuracy, especially at small injection volumes, for example, during pilot injection. Specification, page 3, lines 23 to 25. In the example of a double acting control valve, it has proven to be difficult to determine and apply an activation voltage suitable for all injection elements and the whole lifetime of the injection system with sufficient precision such that, for example, a corresponding valve plug is accurately positioned for maximum fuel flow. Specification, page 3, lines 25 to 31.

It was previously assumed that the relationship between the piezoelectric travel and its voltage could be established with good accuracy and reproducibility by means of a characteristic curve that was determined for all actuators of the same structural design. Specification, page 3, line 33 to page 4, line 3. However, aging symptoms may have a very disruptive effect in operation of the entire injector or the pump element. Specification, page 4, lines 7 to 8.

Moreover, variations in the layer thickness or the number of layers affect the maximum piezoelectric travel for voltage control or charge control. Specification, page 4, lines 10 to 12. By measuring changes of the piezoelectric capacitance over the charging or discharging time with a specified current the disruptive effect due to the aging of

the actuator may be cured. Specification, page 4, lines 12 to 15. Manufacturing tolerances that exist from the outset, however, cannot be eliminated in this way. Specification, page 4, lines 16 to 17.

Therefore the present invention provides for an apparatus and a method for compensating, on an approximate basis, for manufacturing variations in piezoelectric elements, thereby ensuring proper operation of the injectors or pump element containing piezoelectric elements. Specification, page 4, lines 19 to 24.

According to one example embodiment of the present invention, an activation voltage value for charging the piezoelectric element is controlled online by a compensation unit which adjusts the activation voltage and activation charge in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. Specification, page 4, line 31 to page 5, line 3.

According to another example embodiment of the present invention, a definition may be made, prior to charging, as to a value for an activation voltage and an activation charge of the piezoelectric element, as a function of batch variation in the travel of the piezoelectric element. Specification, page 5, lines 5 to 9.

As such, the present invention provides compensation for batch variation in the piezoelectric element's travel due to variations in the layer thickness, or the number of layers (in the case of multi-layer piezoelectric elements) to thereby achieve a higher degree of accuracy in the piezoelectric element's travel. Specification, page 5, lines 11 to 15.

Manufacturing tolerances, such as those that are inevitable in the fabrication of piezoelectric actuators, may be compensated for to ensure a more accurate functioning of the actuator. Specification, page 5, lines 17 to 20.

Thus, an alternative is provided for compensating for the piezoelectric travel without having to measure the

capacitance of the component. Specification, page 5, lines 22 to 25.

In compensating for the above-identified variation in the travel the following equation (1) may be used:

$$h_{actual} = n_{actual} \cdot d_{33} \cdot U_{norm} \qquad (1)$$

Specification, page 27, lines 27 to 30.

In equation (1), n_{actual} is the number of layers of the multi-layer piezoelectric element; d_{33} is the piezoelectric coefficient; U_{norm} is the applied voltage before any correction; and h_{actual} is the lifting distance traveled by the piezoelectric element (which may be measured directly after the manufacturing of the piezoelectric element as one part of the manufacturing process). Specification, page 27, line 32 to page 28, line 3. While it is possible to obtain a full range of data for the lifting (h_{actual}) as a function of voltage, it would require taking repetitive measurements which may be unnecessary. Specification, page 28, lines 4 to 6. Accordingly, for this measurement only the lifting for the maximum voltage U_{max} can be measured. Specification, page 28, lines 6 to 8. That is, for this measurement only U_{norm} would be equal to U_{max}. Specification, page 28, lines 8 to 9. For all other applications U_{norm} is considered to be the voltage which is applied to an ideal piezoelectric element as a target voltage for a certain lift without taking into account any correction values. Specification, page 28, lines 9 to 12.

Equation (1) yields the voltage correction factor K for the voltage as follows:

$$K = h_{norm} / h_{actual} \qquad (2)$$

Specification, page 28, lines 14 to 17. In equation (2) h_{norm} represents the piezoelectric element's standard travel at a given voltage. Specification, page 28, lines 19 to 20. This value represents the expected travel of the piezoelectric element at a given voltage. Specification, page 28, lines 20 to 21.

Therefore, the following holds for voltage U which compensates for the fluctuations in the number of layers or differences in the piezoelectric coefficient d_{33}:

$$U = f_1(K) \; . \; U_{norm} \qquad (3)$$

Specification, page 28, lines 23 to 27.

Similarly, in compensating for fluctuations in the layer thickness a corrected charge value (Q) is determined in the following manner.

$$h_{actual} = d_{actual} . (1/A) . (d_{33}/\varepsilon_{33} . \varepsilon_0) . Q_{norm} \qquad (4)$$

Specification, page 28, lines 29 to 33. Equation (4) holds for the measured start value of the travel where, d_{actual} is the existing averaged-layer thickness; Q_{norm} is the sum of the charges that would be brought on an ideal piezoelectric element for a certain action in the absence of interference from manufacturing or any other anomaly; A is the effective area of the multi-layer actuator and ε_{33} is the dielectric coefficient; and ε_0 is the dielectric coefficient of an ideal piezoelectric element. Specification, page 29, lines 1 to 8. Thus, h_{actual} is a linear function of Q also. Specification, page 29, line 10.

Equation (4) yields charge correction factor $K_Q = K$ in a similar fashion as equation (2):

$$K = h_{norm} \; / \; h_{actual} \qquad (5)$$

Specification, page 29, lines 12 to 15.

The following holds for charge Q which compensates for the fluctuation in the layer thickness:

$$Q = f_2(K) \; . \; Q_{norm} \qquad (6)$$

Specification, page 29, lines 17 to 20.

Therefore, in an embodiment of the present invention, the same correction factor can be used, whether the actuator is going to be charged with a certain voltage or a certain charge. Specification, page 29, lines 22 to 24.

The measured correction factor may be measured for each individual actuator and stored in the control unit. For example, this may be realized within an EEPROM in the control unit. As embodied herein, the respective correction factors may be read from the EEPROM for test purposes. Specification, page 29, lines 26 to 30.

In an example embodiment of the present invention, an apparatus for charging a piezoelectric element is characterized in that an activation voltage and an activation charge value for driving the piezoelectric element is controlled online by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. Claim 1.

In an example embodiment of the present invention, a method for charging a piezoelectric element is characterized in that a definition is made, prior to charging, as to a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of batch variation in the travel of the piezoelectric element. Claim 8.

In an example embodiment of the present invention, an apparatus for charging a piezoelectric element includes a control unit configured to control an activation voltage and an activation charge value to drive the piezoelectric element, the control unit configured to adjust the activation voltage and activation charge value to compensate for a deviation caused by a variation of at least one of a layer thickness of the piezoelectric element and a number of layers of the piezoelectric element. Claim 18.

In an example embodiment of the present invention, a method for charging a piezoelectric element includes the step of defining, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element. Claim 25.

6. **ISSUES**

A. Whether claims 8 to 17 are definite under 35 U.S.C. § 112, second paragraph.

B. Whether claims 1, 3, 4, 18, 20, 21, and 25 are patentable under 35 U.S.C. § 102(b) over Hirotada et al. or Katsuhiro et al.

C. Whether claims 1, 2, 8, 9, 18, 19, 25 and 26 are patentable under 35 U.S.C. § 102(b) over Moloney.

D. Whether claims 3 to 7, 10 to 14, 20 to 24, and 30 to 31 are patentable under 35 U.S.C. § 103(a) over the combination of Moloney and Takada et al. or Jaenker.

E. Whether claims 15 to 17 and 32 to 34 are patentable under 35 U.S.C. § 103(a) over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al.

7. **GROUPING OF CLAIMS**

ISSUE A:

Group I: Claims 8 to 17 stand or fall together.

ISSUE B:

Group I: Claims 1 and 18

Group II: Claims 3, 4, 20, and 21

Group III: Claim 25

With respect to Issue B, claims within each Group stand or fall together with the other claims of that Group. However, each Group of claims does not stand or fall together with any other Group of claims.

ISSUE C:

Group I: Claims 1, 2, 18, and 19

Group II: Claims 8, 9, and 25

Group III: Claim 24

With respect to Issue C, claims within each Group stand or fall together with the other claims of that Group.

However, each Group of claims does not stand or fall together with any other Group of claims.

ISSUE D:

Group I: Claims 3, 10, and 20

Group II: Claims 4, 5, 11, 12, 21, and 22

Group III: Claims 6, 7, 13, 14, 23, 24, 30, and 31

With respect to Issue D, claims within each Group stand or fall together with the other claims of that Group. However, each Group of claims does not stand or fall together with any other Group of claims.

ISSUE E:

Group I: Claims 15, 17, 32 and 34

Group II: Claims 16 and 33

With respect to Issue E, claims within each Group stand or fall together with the other claims of that Group. However, each Group of claims does not stand or fall together with any other Group of claims.

8. ARGUMENTS

A. ISSUE A

Claims 8 to 17 stand finally rejected under 35 U.S.C. § 112 second paragraph as allegedly indefinite. It is respectfully submitted that claims 8 to 17 are not indefinite for the following reasons.

Claims 8 to 17 were finally rejected under 35 U.S.C. § 112, second paragraph as allegedly "vague and indefinite for the reasons noted in paper no 6 (3-27-02)." Final Office Action at p. 2. The Office Action of March 27, 2002 states at page 2 that "[t]hese claims are vague and indefinite in that they purpose [sic] to be drawn to a method for charging but no process or method steps are claimed." The Final Office Action alleges that "no specific recognizable steps are claimed." The Final Office Action also alleges that "[c]laims 8-17 are nothing more than a vague collection of ideas with no definite

steps" and that "[o]ne of ordinary skill in the art could not determine the meters [sic] or boards [sic] of these 'method' claims." Final Office Action at p. 2.

The second paragraph of 35 U.S.C. § 112 merely requires that "the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity." M.P.E.P. § 2173.02 (emphasis added). Moreover, the "focus during examination of claims for compliance with the requirement for definiteness of 35 U.S.C. 112, second paragraph is whether the claim meets the threshold requirements of clarity and precision, not whether more suitable language or modes of expression are available." Id. Indeed, "[s]ome latitude in the manner of expression and the aptness of terms should be permitted," and "Examiners . . . should not reject claims or insist on their own preferences if other modes of expression selected by applicants satisfy the statutory requirement." Id.

It is respectfully submitted that claims 8 to 17 fully comply with the requirements of 35 U.S.C. § 112. For example, claim 8, line 2 recites that "a definition is made," which is believed and respectfully submitted to sufficiently set forth a method step. Claim 12, line 2 recites that a "control unit (D) determines that correction factor," which is also believed and respectfully submitted to sufficiently set forth a method step. Claim 13 recites that "the control unit determines the correction factor," claim 14 recites that "the normal travel distance and the respective actual travel distance are measured," claim 15 recites that "the correction factor is measured," and claim 16 recites that "the correction factor is stored." All of the foregoing limitations are believed and respectfully submitted to sufficiently set forth method steps and do not constitute a "vague collection of ideas with no definitive steps" as alleged in the Final Office Action. It is therefore respectfully submitted that claims 8 to 17 fully comply with the requirements of 35 U.S.C. § 112, and it is respectfully requested that this rejection be reversed.

B. ISSUE B

Claims 1, 3, 4, 18, 20, 21, and 25 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by Hirotada et al. or Katsuhiro et al. It is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claims 1, 3, 4, 18, 20, 21, and 25 for the following reasons.

Hirotada et al. purport to relate to a piezoelectric-element driving device, and Katsuhiro et al. purport to relate to a control circuit for a piezoelectric actuator. As regards the present rejection, the Final Office Action states:

> Claims 1, 3, 4, 18, 20, 21 and 25 are rejected under 35 U.S.C. 102 as anticipated by [Hirotada et al.] or [Katsuhiro et al.]. It is noted that these references were also applied as anticipatory references by the European Search Authority in the Search Report submitted by applicants on 7-9-01. (See the English language abstract) a control circuit for driving a piezo-electric element while compensating for changes caused by ageing, temperature, etc. etc. [sic] <u>Any</u> defect or abnormality would be compensated, including those perceived to originate in the manufacturing process. Thus without specific mention of changes in thickness due to e.g. manufacturing defects, these references inherently compensate for such variatings [sic] by the apparatus and method as disclosed. Note claim [sic] 18 and 1 merely call for apparatus "characterized" or "configured" to perform a desired function. Structurally they only define a piezo-electric actuator and <u>any</u> drive circuit. These narrative type claims, not using "means plus function" language thus would not define from the references even if the references didn't show the desired function noted in applicants [sic] claims. (Emphasis in original).

As an initial matter, whether certain patents or printed publications were cited in the search report submitted on July 6, 2001 is not dispositive on the issue of the patentability of any claims of the present application.

While the Final Office Action appears to be referring to the English-language abstract of only one of

Hirotada et al. and Katsuhiro et al., no clarification is made as to which, if any, is being relied on in the Final Office Action. Furthermore, neither Hirotada et al. nor Katsuhiro et al. provides a description in which any possible defect or abnormality is compensated for, including those perceived to originate in the manufacturing process, as alleged in the Final Office Action.

Notwithstanding the above, to facilitate the proceedings, the merits of these rejections are addressed below to the extent possible despite the lack of clarity of the rejections.

1. GROUP I - CLAIMS 1 AND 18

Claim 1 relates to an apparatus for charging a piezoelectric element. Claim 1 recites that an activation voltage and an activation charge value for driving the piezoelectric element are controlled online by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element layer thickness or the number of layers.

Claim 18 relates to an apparatus for charging a piezoelectric element and recites that the apparatus includes a control unit configured to control an activation voltage and an activation charge value to drive the piezoelectric element, the control unit configured to adjust the activation voltage and activation charge value to compensate for a deviation caused by a variation of at least one of a layer thickness of the piezoelectric element and a number of layers of the piezoelectric element.

To the extent that the rejection is understood, the Examiner appears to be relying on the doctrine of inherency, even though the references fail to describe features recited in the rejected claims, such as compensating for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. However, to the extent the Examiner is relying on the doctrine of inherency, the Examiner

must provide a "basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristics necessarily flows from the teachings of the applied art." See M.P.E.P. § 2112; emphasis in original; and see, Ex parte Levy, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). Thus, the M.P.E.P. and the case law make clear that simply because a certain result or characteristic may occur in the prior art does not establish the inherency of that result or characteristic. That is, "[i]nherency . . . may not be established by probabilities or possibilities," and "[t]he mere fact that a certain thing may result from a given set of circumstances is not sufficient." In re Robertson, 49 U.S.P.Q.2d 1949, 1951 (Fed. Cir. 1999) (quoting In re Oelrich, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981)). The Examiner did not present any basis in fact or technical reasoning to support his reliance on this doctrine. It is respectfully submitted that these features are not inherent, and that the disclosures of the cited references do not disclose, or even suggest, these features, as more fully set forth below.

It is "well settled that the burden of establishing a prima facie case of anticipation resides with the [United States] Patent and Trademark Office." Ex parte Skinner, 2 U.S.P.Q.2d 1788, 1788 to 1789 (Bd. Pat. App. & Inter. 1986) (citing In re Piasecki, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984). To anticipate a claim, each and every element as set forth in the claim must be found in a single prior art reference. Verdegaal Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). That is, the prior art must describe the elements arranged as required by the claims. In re Bond, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990).

Non of the Office Actions to date has not presented evidence showing that either Hirotada et al. or Katsuhiro et

al. discloses all of the features of claims 1 and 18, in as complete detail as is contained in claims 1 and 18. The Final Office Action merely offers the unsupported assertion that even "without specific mention of changes in thickness" and "even if the references didn't show the desired function," these references inherently disclose these features. These statements made may be considered as virtual admissions that these details are not disclosed in the references, and it is respectfully submitted that Appellants believe that these details are not disclosed in the references. Accordingly, each and every element as set forth in claims 1 and 18 cannot be found in either Hirotada et al. or Katsuhiro et al.

More specifically, Hirotada et al. purport to relate to a piezoelectric-element driving device that compensates for the change in expansion amount of a piezoelectric element caused with the change in time and temperature. Abstract. Hirotada et al. state that an expansion amount of a charged piezoelectric element is detected and compared with an specified reference value. Constitution. When the expansion amount reaches the reference value a voltage is held across both ends of the piezoelectric element. Id. The output is monitored and connected to a fail safe device. Id.

Therefore, Hirotada et al. appear to describe a system that merely responds to changes in the amount of expansion detected in the piezoelectric element due to use and age. Hirotada et al. attribute these changes to "change with time, temperature change and the like." Abstract. In contrast, claims 1 and 18 relate to deviations caused by variations in the piezoelectric element's layer thickness or/and the number of layers. While these deviations may also change with respect to the passage of time or a change in temperature, these deviations are also present in the absence of time and temperature changes. The deviations of the claims are due to "manufacturing variation[s]." See Specification, page 1, lines 10 to 11 and page 4, line 22. Therefore, even before the passage of time or even without any change in temperature, the deviations recited in claims 1 and 18 will still be present in

the piezoelectric element. In contrast, Appellants believe that the changes apparently described in Hirotada et al. are changes that only appear, as stated by Hirotada et al., after the passage of time or after temperature changes have affected the piezoelectric element. The difference is important in that the changes apparently described in the Hirotada et al. are not the same as the deviations recited in claims 1 and 18.

Katsuhiro et al. purport to relate to a control circuit for a piezoelectric actuator to drive a multitude of piezoelectric actuators. Abstract. A small number of power sources are connected a capacitor in parallel to the piezoelectric actuators. Id. It appears that Katsuhiro et al. merely describe a circuit in which the positions of a set of piezoelectric actuators is monitored and fed to a controller. Constitution. When the position signal coincides with a set value and electric charge is accumulated in the capacitor, changeover switches are switched to the next set of piezoelectric actuators. Id. Therefore, it is believed that the circuit of Katsuhiro et al. does not relate to the features of claims 1 and 18.

In summary, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, that an activation voltage and an activation charge value for driving the piezoelectric element are controlled by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness and/or the number of layers, as recited in claims 1 and 18.

Therefore, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, all of the limitations of claims 1 and 18. It is therefore respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claims 1 and 18, and it is respectfully requested that the final rejection of these claims be reversed.

2. GROUP II - CLAIMS 3, 4, 20 AND 21

Claims 3 and 4 ultimately depend from claim 1 and therefore include all of the limitations of claim 1. Accordingly, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates these dependent claims for at least the same reasons given above in support of the patentability of claim 1.

Claims 20 and 21 ultimately depend from claim 18 and therefore include all of the limitations of claim 18. Accordingly, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates these dependent claims for at least the same reasons given above in support of the patentability of claim 18.

Regarding claims 3 and 20, these claims further recite that the activation voltage value and the activation charge value are determined as a function of the piezoelectric element's normal voltage, normal charge and a correction factor. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that a correction factor is disclosed by Hirotada et al. or Katsuhiro et al., and it is respectfully submitted that a correction factor is not disclosed, or even suggested, by Hirotada et al. or Katsuhiro et al. Furthermore, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, that a correction factor is used to calculate an activation voltage value and an activation charge value, as recited in claims 3 and 20.

Regarding claims 4 and 21, these claims further recite that the correction factor is a function of a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that this feature is disclosed by either Hirotada et al. or Katsuhiro et al., and it is respectfully submitted that this feature is not disclosed, or even suggested, by either Hirotada et al. or Katsuhiro et al.

In summary, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, all of the limitations of claims 3, 4, 20, and 21. It is, therefore, respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claims 3, 4, 20, and 21, and it is respectfully requested that the final rejection of these claims be reversed.

3. <u>GROUP III - CLAIM 25</u>

Claim 25 relates to a method for charging a piezoelectric element and recites that the method includes defining, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element.

As more fully set forth above, Hirotada et al. appear to describe a system that merely responds to changes in the amount of expansion detected in the piezoelectric element due to use and age. However a batch variation, as described in the Specification of the present invention, is "due to variations in the layer thickness or number of layers" of the piezoelectric element. Specification, page 27, lines 16 to 25. As described in more detail above, the changes in the amount of expansion detected in the piezoelectric element due to use and age, as stated in Hirotada et al., are not the same as the batch variations, as recited in claim 25, which are due to variations in the layer thickness or number of layers.

As more fully set forth above, Katsuhiro et al. appear to describe a circuit in which the position of a set of piezoelectric actuators is monitored and fed to a controller, such that when the position signal coincides with a set value and electric charge is accumulated in a capacitor, changeover switches are switched to the next set of piezoelectric actuators. It is respectfully submitted that the circuit of Katsuhiro et al. does not relate to the features of claim 25.

Therefore, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even

suggests, a method for charging a piezoelectric element in which a definition is made, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element, as recited in claim 25.

In summary, it is respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. discloses, or even suggests, all of the limitations of claim 25. It is therefore respectfully submitted that neither Hirotada et al. nor Katsuhiro et al. anticipates claim 25, and it is respectfully requested that the final rejection of claim 25 be reversed.

C. ISSUE C

Claims 1, 2, 8, 9, 18, 19, 25, and 26 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by Moloney. It is respectfully submitted that Moloney does not anticipate claims 1, 2, 8, 9, 18, 19, 25, and 26 for the following reasons.

1. GROUP I - CLAIMS 1, 2, 18, AND 19

Moloney purports to relate to a valve operating mechanism for internal combustion and like valved engines. As regards the present rejection, the Final Office Action states that:

> Moloney teaches providing a feedback loop to control the charging of a piezo injector. Travel distance is measured and compensated for if it isn't equal to a desired valve [sic] this on-line compensation is constant as conditions charge e.g. were, temperature flection [sic] etc. Thus any abnormalities of piezo expansion and contraction requiring compensation are addressed and corrected.

Final Office Action at p. 3.

However, it is respectfully submitted that Moloney does not disclose, or even suggest, an apparatus for charging a piezoelectric element in which an activation voltage and an activation charge value for driving the piezoelectric element

is controlled online by a control unit which adjusts the activation voltage and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's layer thickness and/or the number of layers, as recited in claims 1 and 18.

Moloney states that Figure 3 includes a "piezo-electric feedback loop control circuit." Col. 3, lines 26 to 27. Of this feedback, Moloney merely states, "the circuit provides for a loop control system so that the movement transmitted by the piezoelectric device(s) to the valve is sensed and any deviation from the correct movement is corrected by means of the control circuit." Col. 3, lines 30 to 35. As stated above, to anticipate a claim, "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim," Richardson v. Suzuki Motor Co., supra, and the prior art must describe the elements arranged as required by the claims, In re Bond, supra.

It is respectfully submitted that Moloney does not present ***each and every element*** of claim 1 in ***as complete detail*** as is contained in claim 1. For example, Moloney states that deviation from correct movement is corrected. However, claim 1 includes the detail that deviations caused by variations in the piezoelectric element's layer thickness or the number of layers are compensated for. Claim 18 includes analogous limitations. This additional detail is important because it distinguishes between the types of changes caused by age of the piezoelectric device, from the deviations caused by manufacturing variations. Moloney appears to be describing the former -- that is, changes caused by age of the piezoelectric device -- because there is no inherent correct positioning of a piezoelectric device that is established during its manufacture. It appears that the positioning deviations would arise after the piezoelectric device has been placed in a particular position and operated for a period of time, such that changes in current positioning relative to its initial positioning may be observed. Therefore, the deviation

of correct positioning stated in Moloney is not the same as the deviations caused by variations in the piezoelectric element's layer thickness and/or the number of layers, as recited in claims 1 and 18.

In summary, is respectfully submitted that Moloney does not disclose, or even suggest, all of the features of claim 1 and 18 and, therefore, does not anticipate claims 1 and 18.

As for claims 2 and 19, claim 2 depends from claim 1 and therefore includes all of the features of claim 1, and claim 19 depends from claim 18 and therefore includes all of the features of claim 18. It is, therefore, respectfully submitted that claim 2 is not anticipated by Moloney for at least the same reasons given above in support of claim 1 and that claim 19 is not anticipated by Moloney for at least the same reasons given above in support of claim 18.

Therefore, it is respectfully submitted that Moloney does not disclose, or even suggest, all of the limitations of claims 1, 2, 18 and 19. It is therefore respectfully submitted that Moloney does not anticipate claims 1, 2, 18 and 19, and it is respectfully requested that the final rejection of claims 1, 2, 18 and 19 be reversed.

2. GROUP II - CLAIMS 8, 9 AND 25

As stated above, Moloney merely states that deviation from correct movement is corrected. However, claims 8 and 25 include the limitation that a definition is made, prior to charging, of certain values as a function of batch variation. Therefore, the deviation of correct positioning stated in Moloney is not the same as the deviations caused by the batch variation, as recited in claims 8 and 25.

Furthermore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Moloney discloses that a definition is made ***prior to charging***, as recited in claims 8 and 25, and it is respectfully

submitted that this feature is not disclosed, or even suggested, by Moloney.

In summary, is respectfully submitted that Moloney does not disclose all of the features of claims 8 and 25 and therefore does not anticipate claims 8 and 25.

As for claim 9, claim 9 depends from claim 8 and therefore includes all of the features of claim 8. It is, therefore, respectfully submitted that claim 8 is not anticipated by Moloney for at least the same reasons given above in support of claim 9.

Therefore, it is respectfully submitted that Moloney does not disclose all of the limitations of claims 8, 9 and 25. It is therefore respectfully submitted that Moloney does not anticipate claims 8, 9 and 25, and it is respectfully requested that the final rejection of claims 8, 9 and 25 be reversed.

3. <u>GROUP III - CLAIM 24</u>

Claim 24 ultimately depends from 18. Accordingly, claim 24 includes all of the limitations of claim 18. Therefore, it is respectfully submitted that Moloney does not anticipate claim 24 for at least the same reasons given above in support of the patentability of claim 18.

Furthermore, as stated above, Moloney merely states that deviation from correct movement is corrected. However, claim 24 includes the limitation that an arrangement configured to measure the normal travel distance and the actual travel distance of the piezoelectric element ***at substantially a same temperature***. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Moloney discloses this feature, and it is respectfully submitted that Moloney does not disclose, or even suggest, this feature.

Therefore, it is respectfully submitted that Moloney does not disclose all of the limitations of claim 24. It is therefore respectfully submitted that Moloney does not

anticipate claim 24, and it is respectfully requested that the final rejection of claim 24 be reversed.

D. ISSUE D

Claims 3 to 7, 10 to 14, 20 to 24, 30, and 31 stand finally rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and Takada et al. or Jaenker. It is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious claims 3 to 7, 10 to 14, and 32 to 34 for the following reasons.

As an initial matter the Final Office Action states that "[c]laims 3-7, 10-14, 20-24 and 10-31 are rejected under 35 U.S.C. 103 as unpatentable over Moloney in view of Takada or Jaenker for the explicit reasons set forth in paper no 6 (3-37-02) [*sic*]." Final Office Action at page 3. It is believed that "10-31" is a typographic error and that what was meant was "30-31."

The Office Action of March 27, 2002 includes a rejection of claims "3-7 and 10-14" under 35 U.S.C. § 103(a) as unpatentable over "Moloney ***or Mitsuyasu*** in view of Takada or Jaenker." Regarding Moloney, the Office Action of March 27, 2002 states that "Moloney ***and Mitsuyasu*** teach compensating a stack of piezoelectric elements in a fuel injector for travel distance based on variation, between actual and ideal conditions" but provides no support for such assertion. Therefore, reference is made to Mitsuyasu, even though the present rejection is based on **only** on the combination of Moloney and Takada et al. or Jaenker. Neither the present Final Office Action nor the Office Action of March 27, 2002 specifies which features of which claims are purported to be disclosed by Moloney, as opposed to those allegedly disclosed by Mitsuyasu, which is no longer relied upon, to form the basis for this rejection. Furthermore, no grounds are provided in either the Office Action of March 27, 2002 or the Final Office Action, on which to base the rejection of claims 20 to 24 and 30 and 31.

The case of In re Wilke, supra, explained that a claim rejection violates 35 U.S.C. § 132 if it is so uninformative that it prevents the applicant from recognizing and seeking to counter the grounds for rejection. It is respectfully submitted that the claim rejections in this section are so uninformative as to violate 35 U.S.C. § 132. Furthermore, as provided in the cases of In re Herrick, 145 U.S.P. 400 (C.C.P.A. 1965) and Ex parte Blanc, 13 U.S.P.Q.2d 1383 (Bd. Pat. App. & Inter. 1989), the form of the present rejection "Moloney in view of Takada [et al.] or Jaenker" constitutes a procedural failure to establish a prima facie case of obviousness since "[a] rejection so stated defeats the intent and purpose of 35 U.S.C. 132." Ex parte Blanc, 13 U.S.P.Q.2d at 1385 (quoting In re Herrick, supra). Therefore it is respectfully requested that the rejection of these claims be reversed for at least the above reasons.

Notwithstanding the above, to facilitate the proceedings, the merits of these rejections are addressed below to the extent possible despite the lack of clarity of the rejections.

As an initial matter, obviousness must be determined with reference to that which would have been obvious to one of ordinary skill in the art at the time the invention was made. Environmental Designs, Ltd. v. Union Oil Co., 713 F.2d 693, 218 U.S.P.Q. 865 (Fed. Cir. 1983), cert. denied, 464 U.S. 1043 (1984). None of the Office Actions to date even allege that it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify or combine the cited references. Indeed, the Office Action of March 27, 2002 merely alleges that "[i]t would have been obvious to one of ordinary skill in the are [*sic*] to select from among known compensation techniques and thus to use voltage factors in the devices of Moloney or Mitsuyasu." Office Action of March 27, 2002 at p. 3. Therefore, this rejection appears to be based on improper hindsight reasoning since the rejection is not even based on what would have been obvious to one of ordinary skill in the art at the time the invention was made.

The cases of In re Fine, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988) and In re Jones, 21 U.S.P.Q.2d 1941 (Fed. Cir. 1992), make plain that the Office Actions' generalized assertions that it would have been obvious to modify or combine the references do not properly support a § 103 rejection. It is respectfully submitted that those cases make plain that the rejection in the Final Office Action reflects a subjective "obvious to try" standard, and therefore does not reflect the proper evidence to support an obviousness rejection based on the references relied upon. In particular, the Court in the case of In re Fine stated that:

> The PTO has the burden under section 103 to establish a *prima facie* case of obviousness. It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. This it has not done. . . .
>
> **Instead, the Examiner relies on hindsight in reaching his obviousness determination. . . . One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.**

In re Fine, 5 U.S.P.Q.2d at 1598 to 1600 (citations omitted; italics in original; emphasis added). Likewise, the Court in the case of In re Jones stated that:

> Before the PTO may combine the disclosures of two or more prior art references in order to establish *prima facie* obviousness, there must be some suggestion for doing so, found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. . . .
>
> **Conspicuously missing from this record is any evidence, other than the PTO's speculation (if it be called evidence) that one of ordinary skill . . . would have been motivated to make the modifications . . . necessary to arrive at the claimed [invention].**

In re Jones, 21 U.S.P.Q.2d at 1943, 1944 (citations omitted; italics in original).

That is exactly the case here since it is believed and respectfully submitted that the Final Office Action offers no evidence whatsoever, but only conclusory hindsight, reconstruction and speculation, which these cases have indicated does not constitute evidence that will support a proper obviousness finding. Unsupported assertions are not evidence as to why a person having ordinary skill in the art at the time of the invention would be motivated to modify or combine references to provide the claimed subject matter of the claims to address the problems met thereby. Accordingly, the Office has not provided proper evidence of a motivation for modifying or combining the references to provide the claimed subject matter.

More recently, the Federal Circuit in the case of In re Kotzab has made plain that even if a claim concerns a "technologically simple concept" -- which is not the case here -- there still must be some finding as to the "specific understanding or principle within the knowledge of a skilled artisan" that would motivate a person having no knowledge of the claimed subject matter to "make the combination in the manner claimed," stating that:

> In this case, the Examiner and the Board fell into the hindsight trap. The idea of a single sensor controlling multiple valves, as opposed to multiple sensors controlling multiple valves, is a technologically simple concept. With this simple concept in mind, the Patent and Trademark Office found prior art statements that in the abstract appeared to suggest the claimed limitation. But, there was no finding as to the specific understanding or principle within the knowledge of a skilled artisan that would have motivated one with no knowledge of Kotzab's invention to make the combination in the manner claimed. In light of our holding of the absence of a motivation to combine the teachings in Evans, we conclude that the Board did not make out a proper prima facie case of obviousness in rejecting [the] claims . . . under 35 U.S.C. Section 103(a) over Evans.

In re Kotzab, 55 U.S.P.Q.2d 1313, 1318 (Fed. Cir. 2000) (emphasis added). Again, it is believed that there have been no such findings and it is respectfully submitted that no such finding have been offered in either the Office Action of March 27, 2002 or the Final Office Action.

Of course, in rejecting a claim under 35 U.S.C. § 103(a), the Examiner bears the initial burden of presenting a prima facie case of obviousness. In re Rijckaert, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). To establish prima facie obviousness, three criteria must be satisfied. First, there must be some suggestion or motivation to modify or combine reference teachings. In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). This teaching or suggestion to make the claimed combination must be found in the prior art and not based on the application disclosure. In re Vaeck, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Second, there must be a reasonable expectation of success. In re Merck & Co., Inc., 800 F.2d 1091, 231 U.S.P.Q. 375 (Fed. Cir. 1986). Third, the prior art reference(s) must teach or suggest all of the claim limitations. In re Royka, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). As indicated above, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 3 to 7, 10 to 14, 20 to 24, 30 and 31.

It is therefore, respectfully submitted that a proper prima facie case of obviousness has not been presented, and it is respectfully requested that the final rejection of these claims be reversed for at least the above reasons.

1. GROUP I - CLAIMS 3, 10, and 20

Claim 3 ultimately depends from claim 1 and therefore include all of the limitations of claim 1, claim 10 ultimately depends from claim 8 and therefore includes all of the limitations of claim 8, and claim 20 depends from claim 18 and therefore includes all of the limitations of claim 18. As more fully set forth above with respect to claims 1, 8 and 18,

it is respectfully submitted that Moloney does not disclose, or even suggest, all of the limitations of claims 1 and 18, such as compensating for deviations caused by variations in the piezoelectric element's layer thickness or the number of layers. Additionally, Moloney does not disclose, or even suggest, all of the limitations of claims 8, such as that a definition is made, prior to charging, of certain values as a function of batch variation in the travel of the piezoelectric element. Therefore, it is respectfully submitted that claim 3 is patentable over Moloney for at least the same reasons given above in with respect to claim 1, claim 10 is patentable over Moloney for at least the same reasons given above in with respect to claim 8, and claim 20 is patentable over Moloney for at least the same reasons given above in with respect to claim 18.

Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Takada et al. or Jaenker disclose the above features of the claims that are not disclosed by Moloney, and it is respectfully submitted that neither Takada et al. nor Jaenker discloses, or even suggests, the above features of the claims that are not disclosed by Moloney.

Furthermore, claims 3, 10 and 20 further recite that the control unit determines the activation voltage value and the activation charge values respectively as a function of the piezoelectric element's normal voltage, normal charge and a correction factor.

The Office Action of March 27, 2002 contends that "Takada [et al.] and Jaenker teach measuring the relationship between voltage and displacement and thus obtaining a correction factor" but provides no support for this assertion. However, even though Appellants do not necessarily agree with this assertion, even if it were true, it still would not provide a basis for rejection of the claims. This assertion only states that the references purportedly disclose that a correction factor is derived from a relationship between voltage and displacement. However, claims 3, 10 and 20 recite

that three characteristics of the piezoelectric element are taken into account in determining the activation values: the piezoelectric element's normal voltage, normal charge and a correction factor. As stated above in the section summarizing the invention, the correction factor is not based on a simple relationship between voltage and displacement. The specification provides, regarding calculation of the correction factor:

> While it is possible to obtain a full range of data for the lifting (h_{actual}) as a function of voltage, it would require taking repetitive measurements which may be unnecessary. Accordingly, for this measurement only the lifting for the maximum voltage U_{max} can be measured. That is, for this measurement only U_{norm} would be equal to U_{max}. For all other applications U_{norm} is considered to be the voltage which is applied to an ideal piezoelectric element as a target voltage for a certain lift without taking into account any correction values.

Specification, page 28, lines 4 to 12.

The correction factor of the present claims takes into account features including the number of layers of the multi-layer piezoelectric element, the voltage applied before any correction, and the lifting distance as measured directly after manufacturing of the piezoelectric element. Specification, page 27, line 32 to page 28, line 3. It is noted that these are measurements representing "variations in the piezoelectric element's layer thickness or the number of layers" (as recited in claims 1, 8, and 18, from which claims 3, 10, and 20 respectively depend) which are used in deriving the activation values which compensate for the deviations. Therefore, the correction factor of the assertions contained in the Office Action of March 27, 2002 is not the same as and does not correspond to the correction factor of the present invention, as recited in the claims.

Therefore, even if the Office Actions' assertion is correct, and Appellants do not necessarily agree that it is, the combination of Moloney and Takada et al. or Jaenker still

does not disclose all of the features of the claims. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that Takada et al. or Jaenker discloses using a ***normal voltage***, a ***normal charge***, and a correction factor in determining activation values, as recited in claims 3, 10, and 20, and it is respectfully submitted that these references do not disclose, or even suggest, the above features of claims 3, 10, and 20.

As understood, Takada et al. relate to a method and device for driving piezoelectric elements in a micromotion mechanism, in which a linear or a quadratic expression characterizing the displacement of the piezoelectric element per unit voltage in various voltage ranges is employed. Col. 3 line 64 to col. 4, line 33. Jaenker, as understood, relates to a method for calibrating a piezoelectric actuation drive by mathematically interpolating a function relating "displacement positions of an actuator beam 4 [which is moved via the piezoelectric element] between stops 9A and 9B, as a function of the applied energizing voltage." Col. 4, lines 38 to 43.

Therefore, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, that a normal voltage, a normal charge, and a correction factor are used in determining activation values, as recited in claims 3, 10, and 20.

Accordingly, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 3, 10 and 20. It is, therefore, respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious claims 3, 10 and 20, and it is respectfully requested that the final rejection of these claims be reversed.

2. GROUP II - CLAIMS 4, 5, 11, 12, 21, AND 22

Claims 4 to 5 depend from claim 3 and ultimately depend from claim 1 and therefore include all of the

limitations of claims 1 and 3, claims 11 to 12 depend from claim 10 and ultimately depend from claim 8 and therefore include all of the limitations of claim 8 and 10, and claims 21 to 22 depend from claim 20 and ultimately depend from claim 18 and therefore include all of the limitations of claims 18 and 20. As more fully set forth above with respect to claims 1, 3, 8, 10, 18, and 20, the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of these claims.

Therefore, it is respectfully submitted that claims 4 to 5 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claims 1 and 3, that claims 11 to 12 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claim 8 and 10, and that claims 21 to 22 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claim 18 and 20.

Furthermore, claims 4, 11, and 21 further recite that the correction factor is a function of a piezoelectric element's normal travel distance and the piezoelectric element's respective actual travel distance. As more fully set forth above, the Office Action of March 27, 2002 alleges at p. 3 that Takada et al. and Jaenker disclose "measuring the relationship between voltage and displacement and thus obtaining a correction factor." Therefore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses a correction factor that is a function of a piezoelectric element's normal travel distance and the piezoelectric element's respective actual travel distance, as recited in claims 4, 11, and 21, and it is respectfully submitted that these features of claims 4, 11, and 21 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker.

Claims 5, 12, and 22 depend respectively from claims 4, 11, and 21 and are therefore patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in support of the patentability of claims 4, 11, and 21.

Additionally, claims 5, 12, and 22 further recite that the control unit determines the correction factor by dividing the piezoelectric element's normal travel distance by the piezoelectric element's respective actual travel distance. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses that the control unit determines the correction factor by dividing the piezoelectric element's normal travel distance by the piezoelectric element's respective actual travel distance, as recited in claims 5, 12, and 22, and it is respectfully submitted that these features of claims 5, 12, and 22 are not disclosed, or even suggested, by the references.

In summary, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 4 to 5, 11 to 12, and 21 to 22. It is therefore respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious 4 to 5, 11 to 12, and 21 to 22, and it is respectfully requested that the final rejection of these claims be reversed.

3. GROUP III - CLAIMS 6, 7, <u>13, 14, 23, 24, 30 AND 31</u>

Claims 6 to 7 depend from claim 3 and ultimately depend from claim 1 and therefore include all of the limitations of claims 1 and 3, claims 13 to 14 depend from claims 10 and ultimately depend from claim 8 and therefore include all of the limitations of claim 8 and 10, and claims 23 to 24 depend from claim 20 and ultimately depend from claim 18 and therefore include all of the limitations of claims 18 and 20. Claims 30 and 31 ultimately depend from claim 25,

which includes subject matter similar to claim 8. Claims 30 and 31 depend from claim 27, which includes subject matter similar to claim 10. As more fully set forth above with respect to claims 1, 3, 8, 10, 18, and 20, the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of these claims, nor claims 25 and 27, which recite similar subject matter.

Therefore, it is respectfully submitted that claims 6 to 7 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claims 1 and 3, that claims 13 to 14 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claim 8 and 10, that claims 23 to 24 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claim 18 and 20, and that claims 30 and 31 are patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in with respect to claims 25 and 27.

Furthermore, claims 6, 13, 23, and 30 further recite that the control unit determines the correction factor as a function of temperature. As more fully set forth above, the Office Action of March 27, 2002 merely alleges at p. 3 that Takada et al. and Jaenker disclose "measuring the relationship between voltage and displacement and thus obtaining a correction factor." Therefore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses that the control unit determines the correction factor as a function of temperature, as recited in claims 6, 13, 23, and 30 and it is respectfully submitted that these features of claims 6, 13, 23, and 30 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker.

Claims 7, 14, and 24 depend respectively from claims 5, 12, 22, and are therefore patentable over the combination

of Moloney and Takada et al. or Jaenker for at least the same reasons given above in support of the patentability of claims 5, 12, 22. Claim 31 depends from claim 30 and is therefore patentable over the combination of Moloney and Takada et al. or Jaenker for at least the same reasons given above in support of the patentability of claim 30.

Additionally, claims 7, 14, 24, and 31 further recite the normal travel distance and the respective actual travel distance are measured at substantially the same temperature. Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that the combination of Moloney and Takada et al. or Jaenker discloses that the normal travel distance and the respective actual travel distance are measured at substantially the same temperature, as recited in claims 7, 14, 24, and 31, and it is respectfully submitted that these features of claims 7, 14, 24, and 31 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker.

In summary, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 6 to 7, 13 to 14, 23 to 24, and 30 to 31. It is, therefore, respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not render obvious 6 to 7, 13 to 14, 23 to 24, and 30 to 31, and it is respectfully requested that the final rejection of these claims be reversed.

E. ISSUE E

Claims 15 to 17 and 32 to 34 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. It is respectfully submitted that claims 15 to 17 and 32 to 34 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. for the following reasons.

As an initial matter, it is respectfully submitted that this rejection is so uninformative as to violate 35

U.S.C. § 132. Furthermore, it is respectfully submitted that the form of the present rejection "Moloney in view of Takada [et al.] or Jaenker and combined with Baron [sic] or Estevenon [et al.]" constitutes a procedural failure to establish a prima facie case of obviousness since "[a] rejection so stated defeats the intent and purpose of 35 U.S.C. 132." Ex parte Blanc, 13 U.S.P.Q.2d at 1385 (quoting In re Herrick, supra). Therefore it is respectfully requested that the rejection of these claims be reversed for at least the above reasons.

Notwithstanding the above, to facilitate the proceedings, the merits of these rejections are addressed below to the extent possible despite the lack of clarity of the rejections.

1. **GROUP I - CLAIMS 15, 17, 32, AND 34**

Claims 15 and 17 depend from claim 10 and ultimately depend from claim 8 and therefore include all of the limitations of claims 8 and 10, and claims 32 to 34 depend from 27 and ultimately depend from claim 25 and therefore include all of the limitations of claims 25 and 27. As more fully set forth above with respect to claims 8, 10, 25, and 27, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or even suggest, all of the limitations of claims 8, 10, 25 and 27.

Therefore, it is respectfully submitted that claims 15 and 17 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. for at least the same reasons given above in with respect to claims 8 and 10, and claims 32 and 34 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. for at least the same reasons given above with respect to claim 25 and 27.

Furthermore, claims 15 and 32 further recite that the correction factor is measured as a part of the manufacturing process. In support of this rejection, the Office Action of March 27, 2002 states, at page 3:

> These claims add that an EEPROM is used to record manufacturing history developed correction factors. Each of Barron and Estevnon [sic] teach using an EEPROM to record the history of each value of an injector system.

The Final Office Action merely refers to the Action of March 27, 2002 with respect to this rejection.

Therefore, neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that either Barron or Estevenon et al. discloses that the correction factor is measured as a part of the manufacturing process, as recited in claims 15 and 32, and it is respectfully submitted that these features of claims 15 and 32 are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. Claims 17 and 34 depend respectively from claims 15 and 32 and therefore include all of the features of these claims.

In summary, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. does not disclose, or even suggest, all of the limitations of claims 15, 17, 32, and 34. It is therefore respectfully submitted that the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. does not render obvious 15, 17, 32, and 34, and it is respectfully requested that the final rejection of these claims be reversed.

2. <u>GROUP II - CLAIMS 16 AND 33</u>

Claim 16 depends from claim 10 and ultimately depends from claim 8 and therefore includes all of the limitations of claims 8 and 10, and claim 33 depends from claim 27 and ultimately depends from claim 25 and therefore includes all of the limitations of claims 25 and 27. As more fully set forth above with respect to claims 8, 10, 25, and 27, it is respectfully submitted that the combination of Moloney and Takada et al. or Jaenker does not disclose, or

even suggest, all of the limitations of claims 8, 10, 25 and 27.

Neither the Office Action of March 27, 2002 nor the Final Office Action even alleges that either Barron or Estevenon et al. discloses the features of these claims that were not disclosed by the combination of Moloney and Takada et al. or Jaenker, and it is respectfully submitted that these features of the claims are not disclosed, or even suggested, by the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al. Therefore, it is respectfully submitted that claims 16 and 33 are patentable over the combination of Moloney and Takada et al. or Jaenker and Barron or Estevenon et al., for at least the reasons stated above, and it is respectfully requested that the final rejection of these claims be reversed.

9. CONCLUSION

For at least the reasons indicated above, Appellants respectfully submits that the art of record does not teach or suggest Appellants' invention as recited in the claims of the above-identified application. Accordingly, it is respectfully submitted that the invention recited in the claims of the present application is new, non-obvious and useful. Reversal of the Examiner's rejection of the claims is therefore respectfully requested.

Respectfully submitted,

Dated: October 10, 2003 By: [signature]

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APPENDIX

1. An apparatus for charging a piezoelectric element (10, 20, 30, 40, 50 or 60), characterized in that an activation voltage and an activation charge value for driving the piezoelectric element (10, 20, 30, 40, 50 or 60) is controlled online by a control unit (D) which adjusts the activation voltage (U) and activation charge values in order to compensate for deviations caused by variations in the piezoelectric element's (10, 20, 30, 40, 50 or 60) layer thickness or the number of layers.

2. The apparatus as defined in claim 1, characterized in that the piezoelectric element (10, 20, 30, 40, 50 or 60) is an actuator in a fuel injection system.

3. The apparatus of claim 1, characterized in that the control unit determines the activation voltage value and the activation charge values respectively as a function of the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal voltage, normal charge and a correction factor.

4. The apparatus of claim 3, characterized in that the correction factor is a function of a piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance and the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

5. The apparatus of claim 4, characterized in that the control unit determines the correction factor by dividing the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance by the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

6. The apparatus of claim 3, characterized in that the control unit (D) determines the correction factor as a function of temperature.

7. The apparatus of claim 5, characterized in that the normal travel distance and the respective actual travel distance are measured at substantially the same temperature.

8. A method for charging a piezoelectric element (10, 20, 30, 40, 50 or 60), characterized in that a definition is made, prior to charging, as to a value for an activation voltage (U) and a value for an activation charge of the piezoelectric element (10, 20, 30, 40, 50 or 60) as a function of batch variation in the travel of the piezoelectric element (10, 20, 30, 40, 50 or 60).

9. The method as defined in claim 8, characterized in that the piezoelectric element (10, 20, 30, 40, 50 or 60) is an actuator in a fuel injection system.

10. The method as defined in claim 8, characterized in that the activation voltage and the activation charge values respectively, are a function of the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal voltage, the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal charge and a correction factor.

11. The method as defined in claim 10, characterized in that the correction factor is a function of the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance and the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

12. The method as defined in claim 11, characterized in that a control unit (D) determines that correction factor by dividing the piezoelectric element's (10, 20, 30, 40, 50 or 60) normal travel distance to the piezoelectric element's (10, 20, 30, 40, 50 or 60) respective actual travel distance.

13. The method as defined in claim 10, characterized in that the control unit determines the correction factor as a function of temperature.

14. The method as defined in claim 13, characterized in that the normal travel distance and the respective actual travel distance are measured at substantially the same temperature.

15. The method as defined in claim 10, characterized in that the correction factor is measured as a part of the manufacturing process.

16. The method as defined in claim 10, characterized in that the correction factor is stored for each cylinder within an EEPROM of the control unit (D).

17. The method as defined in claim 16, characterized in that the correction factor can be read from the EEPROM for test purposes.

18. An apparatus for charging a piezoelectric element, comprising:

a control unit configured to control an activation voltage and an activation charge value to drive the piezoelectric element, the control unit configured to adjust the activation voltage and activation charge value to compensate for a deviation caused by a variation of at least one of a layer thickness of the piezoelectric element and a number of layers of the piezoelectric element.

19. The apparatus according to claim 18, wherein the piezoelectric element includes an actuator in a fuel injection system.

20. The apparatus according to claim 18, wherein the control unit is configured to determine the activation voltage

and the activation charge value as a function of at least one of a normal voltage, a normal charge and a correction factor.

21. The apparatus according to claim 20, wherein the correction factor is a function of a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element.

22. The apparatus according to claim 21, wherein the control unit is configured to determine the correction factor in accordance with a division of the normal travel distance by the actual travel distance.

23. The apparatus according to claim 20, wherein the control unit is configured to determine the correction factor as a function of temperature.

24. The apparatus according to claim 22, further comprising an arrangement configured to measure the normal travel distance and the actual travel distance at substantially a same temperature.

25. A method for charging a piezoelectric element, comprising the step of defining, prior to charging, a value for an activation voltage and a value for an activation charge of the piezoelectric element as a function of a batch variation in a travel of the piezoelectric element.

26. The method according to claim 25, wherein the piezoelectric element includes an actuator in a fuel injection system.

27. The method according to claim 25, wherein the activation voltage and the activation charge are a function of a normal voltage, a normal charge and a correction factor.

28. The method according to claim 27, wherein the correction factor is a function of a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element.

29. The method according to claim 28, further comprising the step of determining the correction factor by a control unit by dividing the normal travel distance by the actual travel distance.

30. The method according to claim 27, further comprising the step of determining the correction factor by a control unit as a function of temperature.

31. The method according to claim 30, further comprising the step of measuring a normal travel distance of the piezoelectric element and an actual travel distance of the piezoelectric element at substantially a same temperature.

32. The method according to claim 27, further comprising the step of measuring the correction factor as a part of a manufacturing process.

33. The method according to claim 27, further comprising the step of storing the correction factor for each cylinder within an EEPROM of a control unit.

34. The method according to claim 33, further comprising the step of reading the correction factor from the EEPROM for test purposes